Compressed Air Magazine

Vol. 41, No. 3 | London - New York - Paris | March, 1936

THE KING SURVEYS HIS REALM
(SEE PAGE 4978)

From HIGH speed to LOW speed

15% TO 25% VARIATION IN SPEED

Vari-Pitch Sheave adjusted for maximum diameter-high speed.

Vari-Pitch Sheave adjusted for minimum diameter-low speed.

WITH THE NEW VARI-PITCH TEXROPE SHEAVE

It requires nothing but a simple adjustment, taking but a few moments, to alter the diameter of this new Vari-Pitch Sheave for Texrope V-Belt Drives; which means that you can alter the speed of your driven machines from 15 to 25% per sheave; if both sheaves are of this type a variation of 30 to 50% is possible.

This vitally important new development in power transmission permits you to make different products on the same machines, some of which require higher speeds, some lower; it permits you to experiment with different speeds to ascertain at just what speed your machines show the greatest efficiency—and do all this without dismantling and buying new drives, but simply by taking a few moments to make the desired adjustment.

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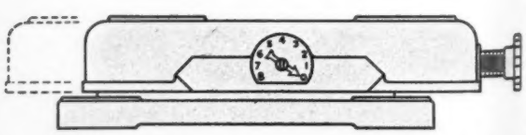

Straitline Automatic Ball Bearing Motor Base developed for the motion control Vari-Pitch Sheave. You simply turn the hand wheel to alter the diameter of the sheave and simultaneously the base moves forward or backward to maintain proper belt tension.

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ORIGINATED BY ALLIS-CHALMERS

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Compressed Air Magazine

MARCH, 1936

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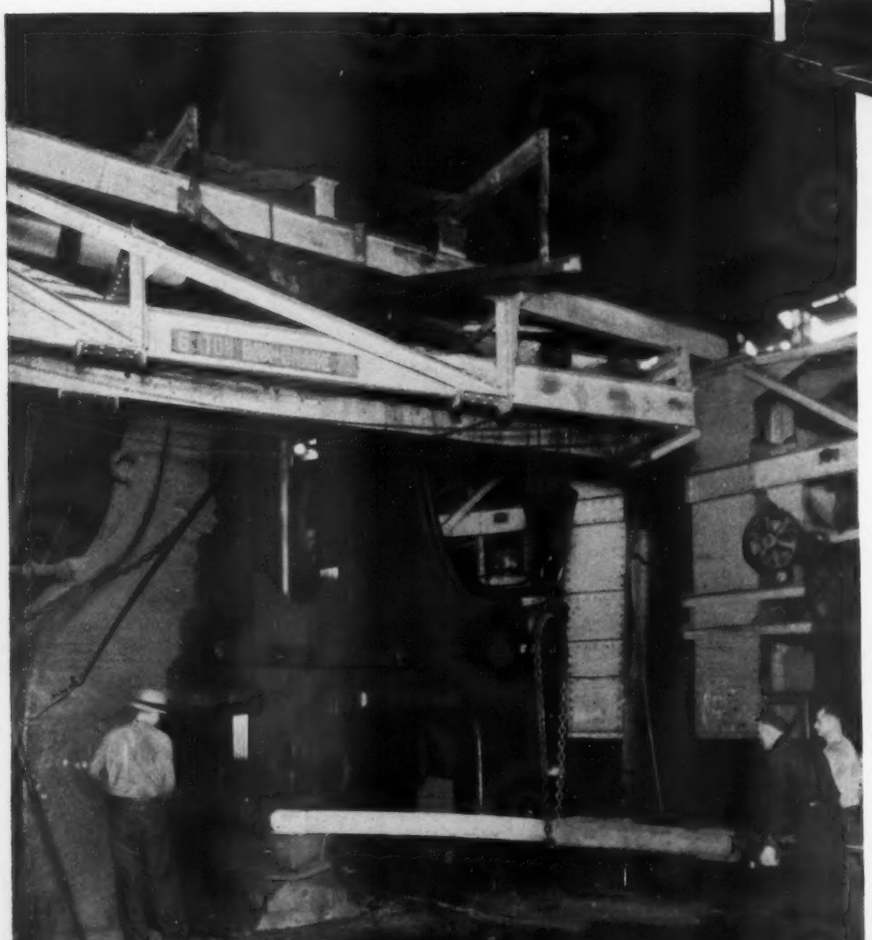
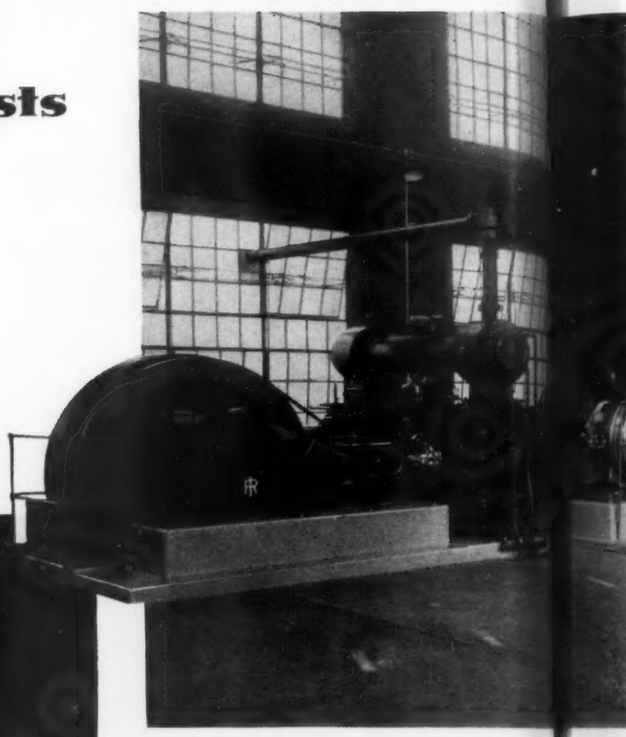
Reducing Forging Costs with Compressed Air

C. H. Vivian



14,000-POUND HAMMER

This double-frame, flat-die hammer is used chiefly for cogging or reducing large billets to sizes that can be handled in the rolling mills. Its operating crew numbers seven men. It is controlled by a lever which is hidden from view by the right-hand frame. This hammer consumes about four times as much power as do the five other smaller hammers in the shop combined. In the background are the furnaces for heating the stock for this hammer.

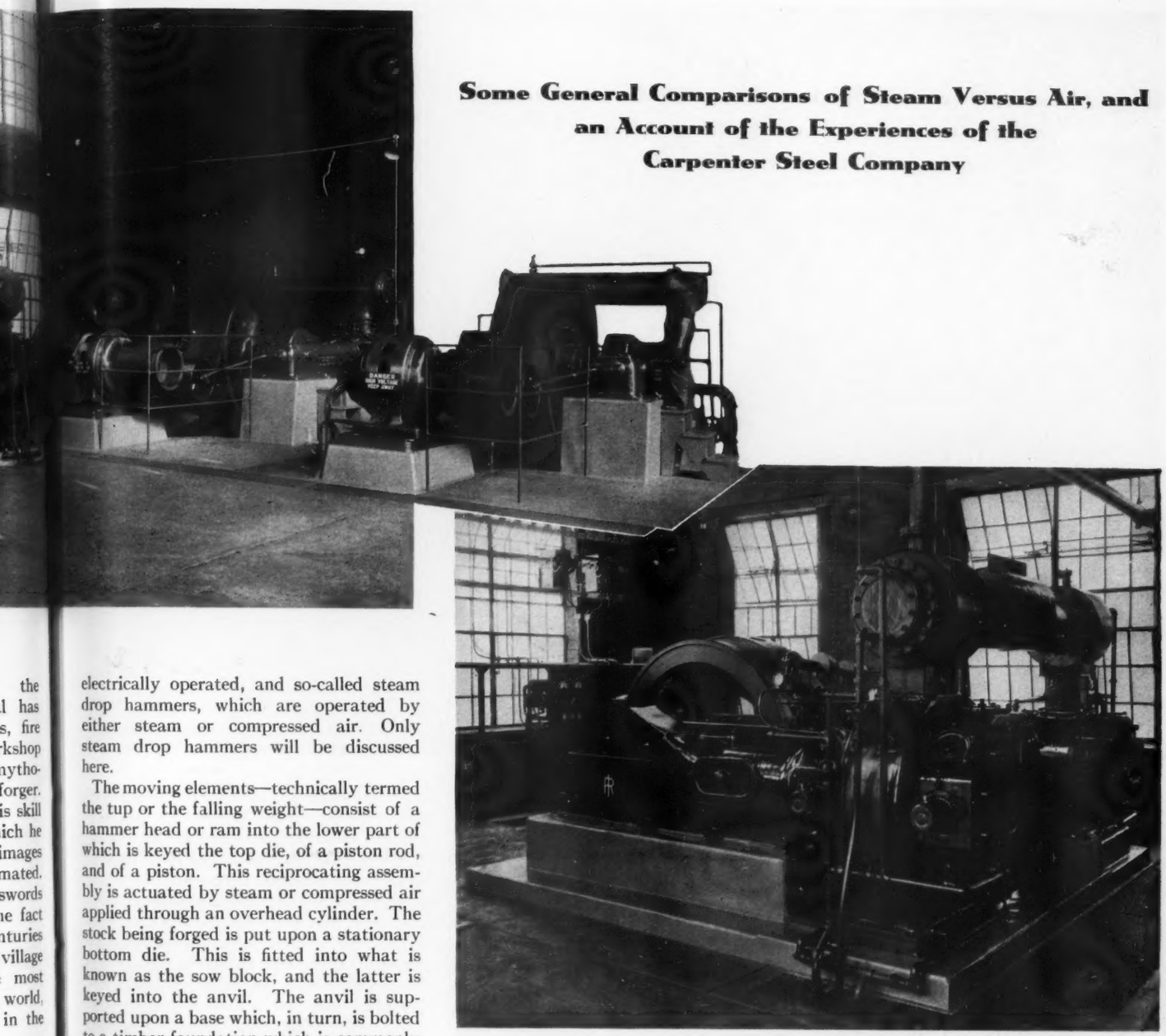


FROM remote times. one of the favored ways of working metal has been by forging it. Hephaestus, fire god of the ancient Greeks whose workshop was on Mount Olympus, was the mythological prototype of the modern forger. Homer made frequent mention of his skill in metallurgy, in the practice of which he was said to have been assisted by images of golden handmaidens that he animated. The Biblical reference to beating swords into plowshares bears witness to the fact that forging was known many centuries ago. In more recent times the village blacksmith has been one of the most picturesque figures of the workaday world, his exploits having been recorded in the literature of all countries.

The forging of metals has steadily developed. Nowadays, even the lay mind recognizes the word "forged" as a connotation of strength. The proper hammering of a piece of steel that has been heated to a plastic state increases its capacity to resist shock and distorting forces, and such articles as shafts, connecting rods, and other parts of machines that must undergo severe service are commonly treated in this manner. Not only steel but also various other metals and their alloys are forged.

In modern industry, mechanical hammers do most of the pounding, striking a rapid succession of herculean blows that would make the best efforts of even the mightiest smith seem puny indeed. Forging hammers are obtainable in a wide range of sizes suitable for handling work of all kinds. Conventional machines are of two types: board drop hammers, which are

Some General Comparisons of Steam Versus Air, and an Account of the Experiences of the Carpenter Steel Company



MAIN COMPRESSOR PLANT

Across the top of the page is a general view in the compressor house. Of the three belt-driven machines, one was installed in 1915 and the two others have been in service since 1920. At the time the forge shop was converted to air operation, these three machines were modernized. There was also purchased a new direct-connected, synchronous-motor-driven unit, which is shown at the left and which also appears in the individual picture just above this description. The four compressors have a combined capacity of 4,807 cfm.

electrically operated, and so-called steam drop hammers, which are operated by either steam or compressed air. Only steam drop hammers will be discussed here.

The moving elements—technically termed the tup or the falling weight—consist of a hammer head or ram into the lower part of which is keyed the top die, of a piston rod, and of a piston. This reciprocating assembly is actuated by steam or compressed air applied through an overhead cylinder. The stock being forged is put upon a stationary bottom die. This is fitted into what is known as the sow block, and the latter is keyed into the anvil. The anvil is supported upon a base which, in turn, is bolted to a timber foundation which is commonly placed underground.

Forging hammers are rated in capacity according to the weight of the falling mass. In many industries individual hammers of 4 or 5 tons, or even heavier, are fairly common. A few years ago a hammer of 100 tons capacity was set up in France for use in the making of armament. In an effort to overcome the effect of its vibrations on neighboring structures, the foundations were carried down to bedrock, and the area on which they rested was isolated from its surroundings by a moat.

There are two general classes of work done by forging hammers. One of these is the forming into definite shapes of pieces such as connecting rods. For such work, both the top and bottom dies have impressions in them, and the ultimate shape produced is the result of their combined action. Surplus metal or "flash" is forced out at the parting line of the dies. In the course of the operations, this flash is trimmed off one or more times by transferring the stock to a trimming press, leaving the forged piece of the exact shape and size desired for subsequent machining. The second class of work consists of merely reducing the section of such large stock as billets, or of forming bars and other simple shapes. For this purpose both the top and bottom dies are flat. Forging hammers of this kind are known as the flat-die type. The stock being worked on must be moved along the comparatively small bottom die as the hammering progresses, and it must be rotated frequently so that its different faces will be struck in turn.

An important potential use of compressed air that has been but meagerly developed is that of operating forging hammers of the types just mentioned. Although there are instances where compressed air has been successfully employed in this service for twenty years or more, the majority of forge shops are still powered by steam. In many cases the selection of

2,500-POUND HAMMER

This is the shop's No. 4 Hammer, with its operating crew of three men. The lever control is clearly shown. By means of it a skilled man can closely regulate the force of each blow.

steam was but logical and natural, because of the necessity of producing it for other essential operations in those plants. Again steam seems to have been chosen for no better reason than that it had been traditionally used and was, accordingly, adopted in good faith without anyone concerned having seriously investigated the comparative costs of steam and air. Today, resourceful, carefully acting managements are disposed to analyze the service conditions involved with a view to determining which will better answer the needs.

Sometimes long-established plants find it advisable to change some of their operating conditions, and in making the changes it develops that there is justification for reconsidering the question of forge-shop power. By way of example, we might cite the Carpenter Steel Company of Reading, Pa., where the replacement of steam by compressed air for operating forging hammers has effected savings which the management estimates at not less than $30,000 a year.

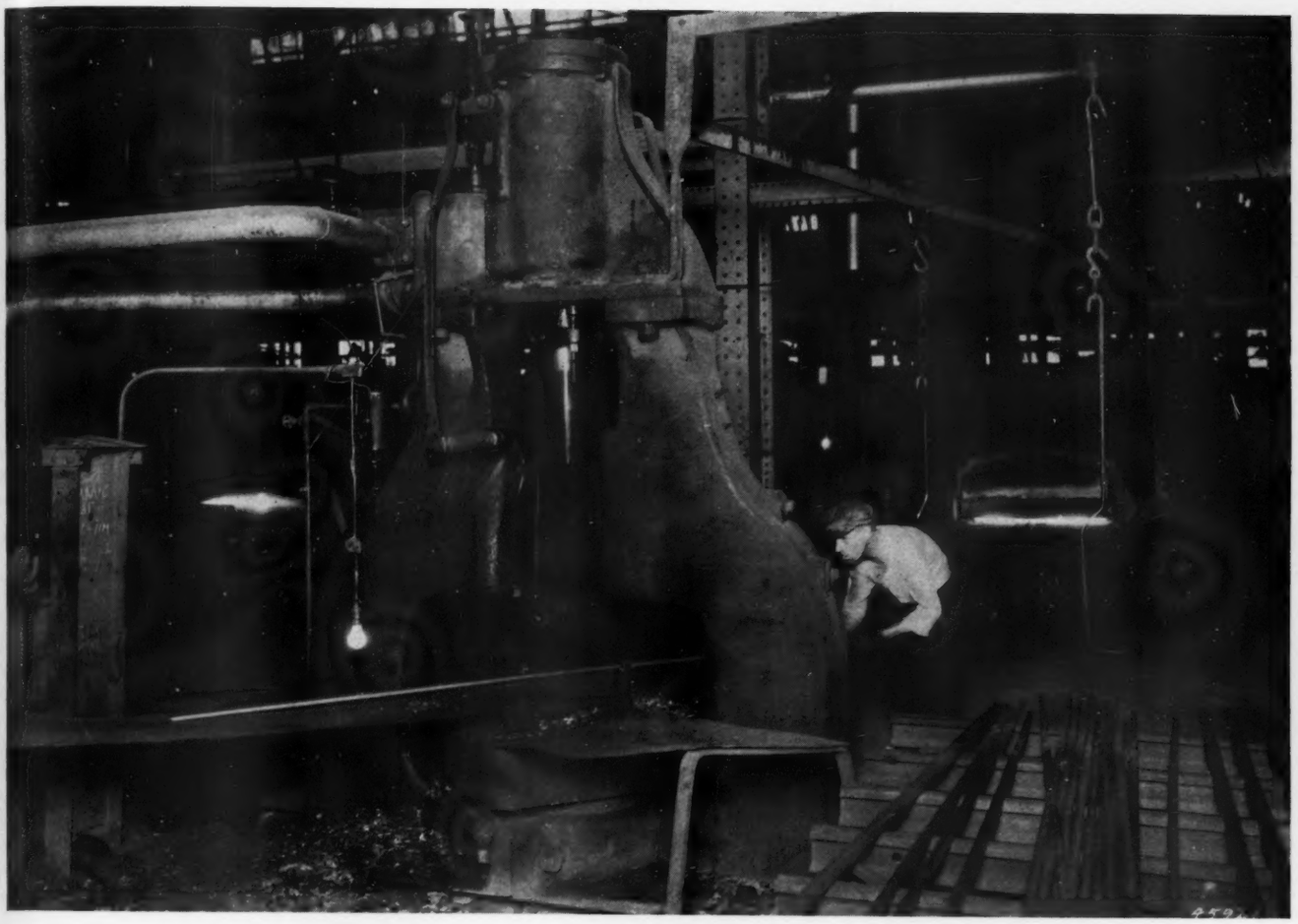
Before discussing the details of this installation, however, it might be well to take up in a general way the question of air versus steam operation, and to set forth some of the factors which ordinarily determine the form of power that will prove to be advantageous. Foremost among the considerations is the schedule and the type of work done—that is, the length of time the hammers operate each day and the character of the forgings turned out. For purposes of discussion, we shall divide forge shops into three classes: production shops, semiproduction shops, and job shops.

Under the first class comes a shop that makes forgings for automobile parts. It usually works on large orders for each part, which means that they can be scheduled accurately and that die changes are infrequent. Furnace equipment is designed to keep the material moving steadily to the hammers, more than one operation on a given piece is generally performed with a single heat, and there is little lost time. Such a shop works 16 to 24 hours a day. Ordinarily it can be run more economically on steam than on air, because with the high load factor on the boiler plant there is justification for making that plant highly efficient and, accordingly, to produce steam at low cost.

In what we have called a semiproduction shop, operations are usually conducted only one shift a day, and large lots of identical parts are not as a rule handled at a stretch. Because of the frequent changes in the material supplied to a given hammer, it is not economical to install the most efficient furnace for each type, and it is not the practice to perform more than one operation with one heat. The conditions just outlined make for considerable standby time. If steam is used, the losses incurred during such nonproductive periods may amount to a fairly large percentage of the total steam consumed. Consequently, the load factor on the boiler plant is decreased materially, and the unit cost of steam consumed for productive purposes becomes correspondingly higher. Such a forge shop may oftentimes be run more economically with air than with steam. Actual determination of this point must be made in each instance upon the basis of a careful analysis of the operating conditions and of the relative costs of steam and compressed air.

The third class of shop—the job shop—is primarily a place in which forgings are made for repair parts, and the forging hammers are predominantly of the flat-die type. Standby time is generally even greater than in the semiproduction class of shop, and the load factor on the boiler plant will therefore be lower. Ordinarily, a shop of this kind will show pronounced savings when operated with air.

Conditions are, of course, seldom the



1,000-POUND HAMMER

Small stock is here being forged for subsequent treatment in the rolling mills. Some of the forgings are shown at the right. Beyond them is the furnace that serves this hammer.

same in any two plants, and there are numerous variables which must be taken into consideration when choosing between steam and air. Where process steam is required for other plant operations, or where steam is produced in waste-heat boilers, the consumption of steam by forging hammers is of no great importance. On the other hand, wherever it is possible to substitute electric power for steam in general plant service, or where steam is being generated primarily to operate forging hammers, it will be advisable to make a detailed study of relative costs of steam and air to determine whether a change to air is desirable. The trend towards air has been aided, in part at least, by the increasing use of electric power and by the consequent reduction or elimination of boiler plants.

We may sum up the subject of the relative costs of steam and air for forging hammers with the statement that air operation gains in economy and steam operation loses in economy as the standby time of hammers increases. In other words, the lower the load factor, the greater is the economy with air; and the higher the load factor, the greater is the economy with steam. The reasons why this is true will be apparent from the following enumeration of the generally accepted advantages of air over steam:

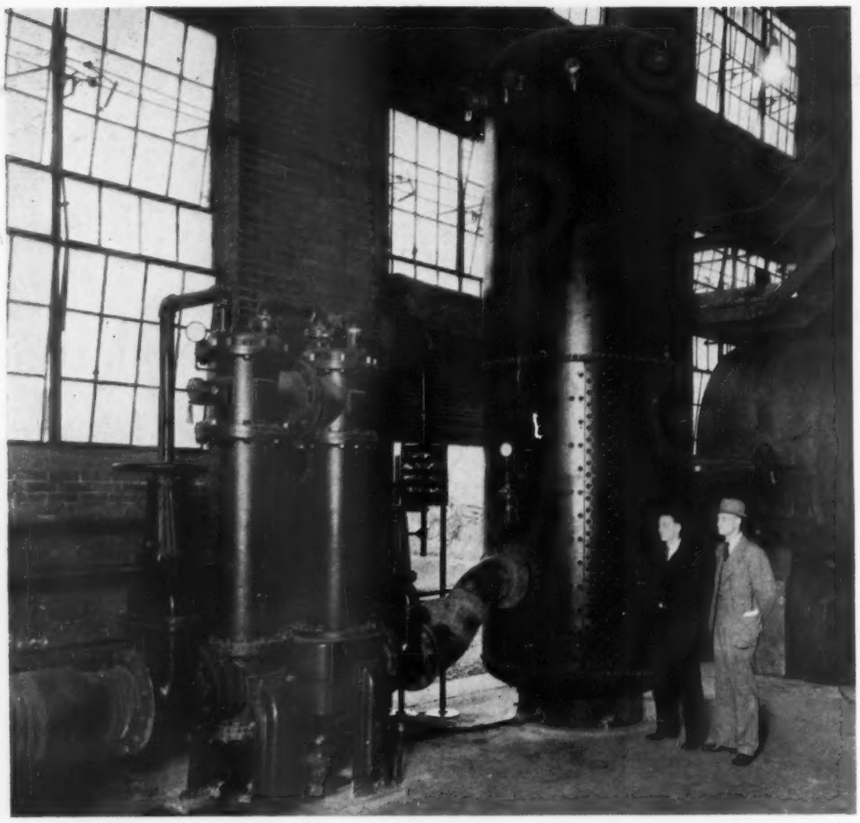
1—Greater operating efficiency. Because of the condensation of steam when it cools in the lines or in the hammer cylinders there is a considerable loss of steam when hammers are not working. It is necessary to "warm up" hammers before the start of a shift, or after any period of nonuse. During such warming-up intervals the hammers consume steam, but do not produce work. Compressed air, on the other hand, will function immediately, and wasted time from this cause is virtually eliminated.

2—Greater flexibility. The electrically operated compressor can be started easily, and air is available in a few minutes, whereas it takes a good deal of time to get up steam. This is of particular value where rush jobs are handled. With modern regulating devices the air supply can be automatically adjusted to meet the demand, and the power cost of the compressor consequently held in close proportion to the work done.

3—Reduction of idling. When steam is used it is necessary to oscillate the hammer continually to keep the cylinder hot and to remove condensation. This is not required with air power, and results in a saving in power costs and in wear on hammer parts. It is not possible entirely to eliminate oscillating some hammers; but idling time can be greatly reduced by careful supervision.

4—Reduction of repair and maintenance costs. Cylinders and piston rods give longer service. Scoring of cylinders is prevented and wear on rods is lessened, as they do not come in contact with live steam and condensation water. For the same reason, packing and calking materials last from two to five times as long as when steam is used. Repairs can be made quicker, as it is not needful to wait for hammers or delivery lines to cool after shutting down. All these factors combine to increase the productive time somewhat when air is used.

5—Less lubricant is required, because air unlike steam does not condense and wash away oil. The absence of condensation likewise makes it unnecessary to insulate delivery lines to guard against loss of heat. Because of that fact short delivery lines are no longer required, and it is possible to locate the compressor plant at a considerable distance from the forge shop without appreciable loss of power. The use of air also obviates the need of heating the forge shop in winter to prevent the freezing of packing in hammer stuffing boxes and to reduce the condensation of steam in pipe lines and cylinders.



AFTERCOOLER AND RECEIVER

Air from the main compressors discharges into 48 feet of 18-inch header, which terminates at the installation here shown. The air is cooled and its moisture content reduced in the vertical Type M aftercooler, and then goes to the 5½x18-foot receiver. From the latter it is transmitted through 1,200 feet of 10-inch pipe to the forge shop, where it is delivered to another but 7½x20-foot receiver, finally reaching the hammers at a pressure of 100 pounds.

6—Greater comfort and cleanliness. The elimination of hot-water drips removes the danger of burns to hammer operators. For this reason workmen usually prefer air. If there is no further need for steam than for operating hammers, the use of air does away with the dirt and ashes from a boiler plant. In some cases it also reduces labor costs by dispensing with firemen.

In service, air gives equally satisfactory results as steam. In most plants that have been converted from steam to air, operators say that air imparts greater "spring" and "snap" to the hammers and that its action is quicker than that of steam. It has been the experience in most such plants that air at 90-95 pounds pressure will insure as good results as steam at 100-125 pounds, or better results.

The conversion from steam to air operation necessitates only comparatively simple hammer adjustments. Initial fits of moving parts are lessened, and air valves are lapped into their cages instead of being given the clearances which are customary with steam operation. The cost of compressing air as compared with that of generating steam will, of course, depend upon many factors, which vary from place to place. Ordinarily, the same quantity of water that is required for boiler feeding in a steam plant will be sufficient for cooling the air in compressor cylinders and intercoolers.

Returning now to a consideration of what has been done at the Carpenter Steel Company, we will presently refer more specifically to the change in conditions that led to the replacement of steam with air in the forge shop. The Carpenter Steel Company is a long-established concern that enjoys a well-merited reputation as a producer of high-grade steels. It specializes in high-carbon and alloy tool steels and in stainless steels, the latter group having grown steadily in importance until it now accounts for approximately half the output, measured in dollars. Carpenter steels find ultimate uses in hundreds of diverse products, ranging from razor blades and high-speed machine tools to automobile-wheel hub caps.

Prior to 1929, steam was mainly depended upon for operating power. The hot-rolling mills were driven by Corliss steam engines; and as steam was also used for heating pickling solutions, for operating six forging hammers of 29,600 pounds total falling weight, and for other purposes, a high load factor was maintained on the boiler plant. The cost of steam was, accordingly, reasonable.

The boiler plant consisted of six 418-hp. units, of which four were in service at a time. Steam was generated at 125-35 pounds pressure and at around 425°F. temperature. The boiler plant was located at a distance of some 1,200 feet from the nearest mill building, and steam was sent to the several mills through a 10-inch insulated line. It was used at full pressure in the Corliss engines and forging hammers, and at reduced pressures for heating pickling baths and for other work.

Following is a list of the forging hammers with their ratings, expressed in pounds of falling weight, and of the percentage of total forge-shop steam which each consumed under normal operating schedules, as determined by time studies:

Hammer	Rating	Steam
No. 1	14,000	79.0%
No. 2	8,000	2.1%
No. 3	3,500	9.8%
No. 4	2,500	6.5%
No. 5	1,000	2.3%
No. 6	600	0.3%

It will be noticed that No. 1 Hammer accounted for 79 per cent of the steam used in the forge shop; and it can be assumed to require approximately the same percentage of air. This large hammer is chiefly employed for cogging—that is, reducing large ingots to sizes that can be handled in the rolling mills, there being no blooming mill in the plant. It operates two shifts a day, whereas all the others are on a 1-shift basis. No.2 Hammer serves principally as a standby for No.1, and is operated only occasionally, which fact accounts for its low power consumption. The remaining hammers are used for forming bars and other conventional shapes. Reference to the table will show that their combined power consumption is only 18.9 per cent of the forge-shop total, or a little less than one quarter of the consumption of No.1 Hammer alone.

A 1927 analysis of the steam consumption showed that about 24,000,000 pounds of steam was being generated per month. Approximately 50 per cent of it was being used to drive the rolls, 25 per cent (6,000,000 pounds) for operating forging hammers, and 25 per cent for other purposes. These figures refer to boiler-plant send-out, and include actual consumption, condensation in the delivery lines, and leakage. At that time it was computed that the steam consumption in the forge shop was 3.2 boiler horsepower per 100 pounds of hammer falling weight in service, of which amount 1.3 boiler horsepower was lost through condensation.

In 1929, with four of the six hammers working (21,000 pounds falling weight), flow-meter readings were taken at intervals of five seconds for a period of one hour to determine the actual steam requirement of the forge shop. The consumption, including condensation, was found to be 14,700 pounds, and for 40 minutes of the

hour it was at the rate of 16,500 pounds per hour. The maximum demand was ascertained to be 25,000 pounds per hour, and the minimum 9,000 pounds. With the hammers idle and all rams in the air, 9,000 pounds of steam was consumed per hour; and with all the rams down, the consumption was 5,000 pounds per hour. These figures represent losses from condensation and leakage.

During the same year—1929—the gross cost of steam was 51.9 cents per 1,000 pounds, and the net cost was 41.8 cents. At times of peak production the annual cost of operating the boiler plant was around $100,000; and in 1931, with activities greatly curtailed, it was $40,000.

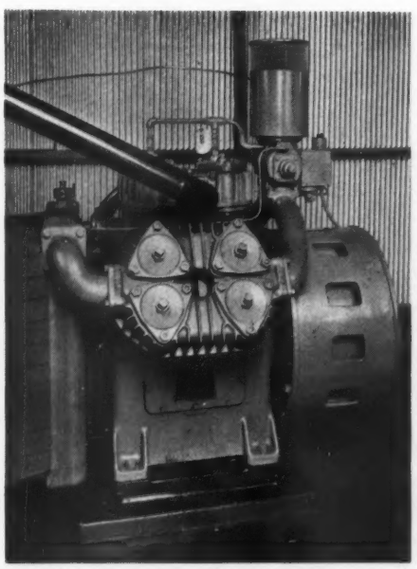
In 1930, electric motors replaced the Corliss engines for driving the rolling mills, this change having been made primarily to obtain greater production. Shortly afterwards, four small vertical oil-fired boilers, totaling 600 hp., were installed in the mills to supply the steam required for the pickling tanks, for heating, etc. The only other major use for high-pressure steam was for operating the forging hammers. Consequently, 85 per cent of the total boiler-plant load fell upon the forge shop, as contrasted with the former 25 per cent. Moreover, a large proportion of the steam delivered to the forge shop was lost through condensation and leakage, as the actual hammering time was but 54 per cent of the crew time. A test of one month's duration during the fall of 1931 showed that of 3,526,600 pounds of steam sent to the hammers only 1,536,600 pounds did useful work, the remaining 1,990,000 pounds being lost through condensation and leakage.

By reason of these altered conditions, it was decided temporarily to convert the hammers to air operation and to make a study with a view to determining whether air operation should be permanently adopted. The change-over was made on May 20, 1932, at which time the generation of steam at the main boiler house was discontinued. During this experimental period only $400 was spent in equipment changes. New packing was placed in the hammer cylinders; new cast-iron valve seats having closer clearances than those used for steam operation were installed; leaks were repaired; and an additional air receiver was set up near the hammers to provide the large volume of air that is often required for immediate use. Compressed air was furnished by the existing compressor equipment, consisting of three Ingersoll-Rand Type XB machines.

A few months of operation convinced the management that air offered worth-while savings and had advantages over steam, and steps were accordingly taken to improve the efficiency of the forge shop and compressor equipment preparatory to making the conversion permanent. Quotations were received from the Chambersburg Engineering Company on new hammer cylinders designed expressly for air operation. Thus far such cylinders have been installed on Hammers Nos. 1, 3, and 4, and consideration is being given to similar installations in the case of the other three hammers.

At the time of the temporary conversion to air, the basement of one of the mill buildings on the bank of a stream served as a compressor room, and water entered it at periods of unusually high floods. It was therefore decided to move the mach e across the stream to the main boiler house and also to rebuild the compressors and to add a fourth and modern unit. One of the three original compressors had been set up in 1915, and the two others in 1920. The principal change was to provide them with new air ends consisting of Type XCB cylinders having plate valves and clearance pockets. These were put on during the latter part of 1932 and the early part of 1933. All three of these units are belt driven from electric motors. During the same period there was purchased a new Ingersoll-Rand Class PRE-2 compressor having 5-step clearance control and being driven by a direct-connected synchronous motor. The compressors now in this central plant are as follows:

Type	Capacity
XCB-2	856 cfm.
XCB-2	1,040 cfm.
XCB-2	1,040 cfm.
PRE-2	1,871 cfm.
Total	4,807 cfm.



MOTORCOMPRESSOR

To increase the air supply and to insure adequate pressure in all parts of the plant, three Motorcompressors, each of 249 cfm. capacity, were installed at different points at the ends of long air lines. These 2-cylinder, air-cooled units are driven by direct-connected motors and require only occasional attention. When there is a moderate demand for air in a local area it can be supplied by one or more of these machines, and it is not necessary to operate the main compressors.

There are also installed at different points in the mill buildings three Ingersoll-Rand "Motorcompressors" each of 249 cfm. capacity. These are located at the ends of long air lines and can be started whenever the demand for air calls for their services. At times, when little air is needed in the mills, one or more of them can be operated and the larger units in the central compressor plant closed down. All the compressors are interconnected by air delivery lines, but provision is made for segregating certain sections of the supply system when air is required in local areas only.

At the central compressor plant, the four units discharge into a header 18 inches in diameter and approximately 48 feet long. Through this the air is conducted to an Ingersoll-Rand vertical aftercooler for the removal of moisture. It then goes to a 5½x18-foot receiver. From there it is delivered to the forge shop through the old steam line, consisting of about 1,200 feet of 10-inch pipe. Within the forge shop the air goes to another receiver, 7½x20 feet, and from there to the hammers. It reaches the points of use at a pressure of 100 pounds.

The amount spent to date for the conversion, including new compressor equipment, is approximately $55,000. Operating costs of the individual hammers have not been ascertained; but, as mentioned earlier, the estimated total saving, based on 3½ years' experience, is at least $30,000 a year. In 1934, an aggregate of 669,000,000 cubic feet of air was compressed. The over-all cost was $0.0434 per 1,000 cubic feet, with power for driving the compressors amounting to $0.01 per kw-hr. Inasmuch as the air-distribution system is interconnected. it is impossible to determine how much air is consumed at the hammers. Other uses for air in the plant are estimated to require 2,000 cfm. under normal service conditions. As the total air supply with all seven compressors operating is 5,554 cfm., the indicated consumption of the hammers is around 3,554 cfm., disregarding leakage losses.

One of the big factors in effecting savings has been found to be the elimination of the necessity of oscillating the hammers in order to prevent condensation when they are not working. Not infrequently, hammers are shut down entirely between heats. There are times, however, when this cannot be done, and under such circumstances it is the practice to float the hammer rams at the upper ends of their strokes.

In commenting upon the efficiency of the forge shop under the new arrangement, E. J. Poole, Sr., vice president in charge of production, stated: "We feel that we are getting as much capacity now as before, or possibly a little more. The hammer operators, while at first opposed to the change, now like air operation better than steam, and would object very much to going back to steam. They feel that the blow of the hammers is just as good as it ever was."

The Laundry Turns to Air

John W. Ripley*

BACK TO THE HOME
Inspecting and wrapping a completed budget bundle.

TO ALL except the smallest of general laundries, compressed air is as familiar today as are the other branches of the laundry power trio, steam and electricity. Compressed air was welcomed and adopted by the industry a decade ago. However, recent mechanical developments, allied with aggressive sales promotion, may help to bring about a much wider use of compressed air in the next few years.

Heretofore, the abnormally high operating costs, particularly in garment pressing, have constituted a barrier between laundries and their greatest potential market: the family washing from 10,000,000 homes. Is that barrier weakening? Last year a few pioneering laundry owners, with plants completely revamped for straight-line production and equipped with new high-production air-powered presses, upset both tradition and existing prices. They turned out, at a profit, a washed and ironed family bundle for ten cents a pound—a rate usually charged for semifinished laundry such as rough dry. So successful was the experiment with the "Budget Bundle," as it is called, that its originators predict that the industry, instead of being content with a scant 20 per cent of the nation's family wash, will eventually serve 80 per cent of the homes.

Damp-wash campaigns of the past two years—most of them conducted coöperatively by groups of laundries—have stimulated interest in laundry-washed clothes. But damp wash is damp wash: the housewife still has the starching and ironing to do. What she wants is freedom from washday, just as the bakers took bread baking out of the home. If damp wash has been the entering wedge, the next step is to give the housewife a finished bundle at an appealing price.

To profitably produce the 20-pound budget bundle for $2, or 20 for 2 as it is abbreviated in advertising, a laundry must show better-than-average efficiency, most particularly in the garment-pressing and hand-ironing department. Generally speaking, the family wash is composed of 50 per cent flatwork (sheets, pillow slips, table cloths, towels, etc.), and of 50 per cent wearing apparel. The work of washing presents no problem, neither does the ironing of flatwork, men's shirts, or underwear. The last two items are of standard sizes and shapes which readily fit laundry presses. But it is not so simple with the women's and children's garments; and they persistently discouraged production engineers until the budget bundle came along.

At the Superior Laundry, Cambridge, Mass., where the budget bundle was created, John Campbell, the manager and a member of the firm, first equipped his plant with the latest Prosperity presses, which but little resemble the early models of 1925. In those days, air-powered presses were merely converted foot-treadle machines that were slow in action and uncertain in pressure and operation. In the new models attention has been given to operator efficiency, safety, increased pressure, and better heat transfer. Results: Press production in the Superior Laundry was immediately increased from 10 pounds to 12 pounds per operator per hour, and the selling price was proportionately reduced.

Even with this increased production the problem of finishing the few pounds of

*Ripley's Laundry, Topeka, Kans.

women's and children's wearing apparel in each family washing was not solved. Campbell took it up with his customers, and found a solution. They expressed a willingness to accept underwear without the usual hand finishing. Consequently, when Campbell eliminated all hand labor on undergarments (they are now pressed double-lay, front and back in one operation), operator production on the entire bundle increased to 14 pounds per hour, a point at which the budget bundle could be sold at a price the average housewife could afford. Results: Within six months the laundry had more than 400 new customers and took in nearly $1,000 more each week. Profits started.

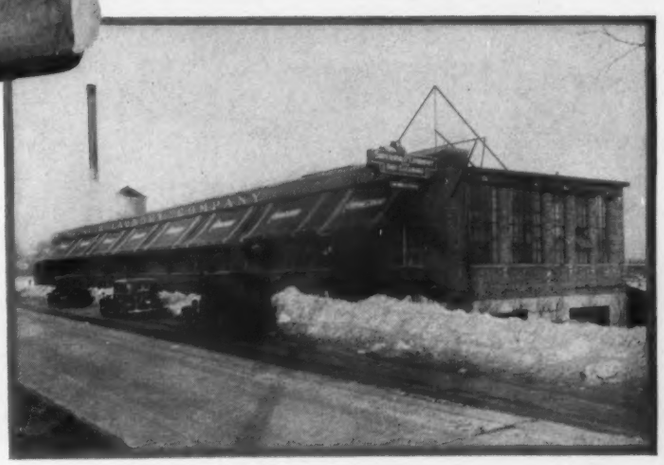
Before the budget bundle was conceived, the business at the Superior Laundry was divided up much like that in hundreds of other laundries: the greatest volume was in the cheapest and least profitable wash—damp wash. The volume of each, as well as the size of each bundle, decreased as the price per pound increased. Today, most budget-bundle laundries find that this ratio is being reversed. In the case of the Superior Laundry, for example, which offers four family services, the wash handled was proportioned as follows before and after the introduction of the budget bundle. The 1935 figures are for the month of December.

	1931	1935
Wet wash	32.8%	4.0%
Thrifty	21.2	1.3
Flatwork	21.1	7.7
Other services (all finished)	24.9	– –
Budget bundle	– –	87.0

After checking and rechecking the Superior Laundry's phenomenal sales increases and lowered production costs, the Prosperity Company, Syracuse, N. Y., released the data to a credulous laundry industry. There was not a laundry convention last year, large or small, that did not listen to the story. Debates, some quite heated, followed. Those of the old school still insist that it cannot be done: the younger operators point to results. More than 100 laundries in 50 cities are at present offering the budget bundle, and the number is continually growing. Competition, if nothing else, will probably cause thousands of laundries soon to give the same or a similar finished service. If their success even approaches that of the plants which are now turning out budget bundles, more and larger air compressors will be required.

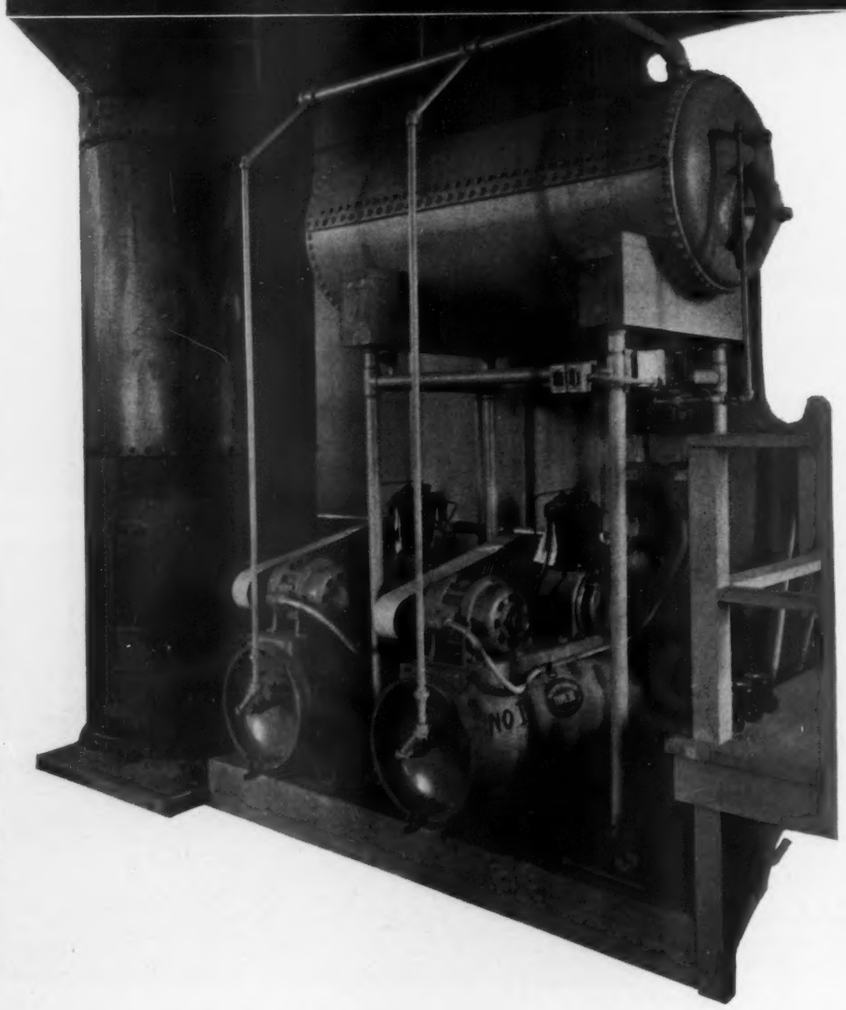
Noteworthy is the Superior's increase in air presses and compressor capacity. Before the day of the budget bundle, that laundry had in use seven presses operated by one 2-hp., 4½x4 compressor. Today it has 41 presses, together with many other pieces of air-driven equipment, which are supplied with air by two 4½x4 units and one 5-hp., 4½x5 compressor. The management is at present considering the advisability of still further augmenting the capacity by installing one compressor large enough to take the place of all the smaller ones and to allow for future expansion.

While compressed-air equipment is usually associated only with the garment-pressing departments, where it was first introduced, today air lines run to every floor, every corner of an up-to-date laundry. Starting with the receiving room, where the family washing is checked and identified by marking or netting, we often find the Protecto Clip System in use. This system has numerous advantages. Instead of marking garments with indelible ink, small, thin monel-metal spring clips bearing a number assigned to the particular wash are fastened to all garments and flatwork with a pneumatic attaching machine. This machine tabulates the number of clips required for each wash, while a detaching machine, also air powered, counts them back and refuses clips that do not carry the same serial number, thus making



BIRTHPLACE OF THE BUDGET BUNDLE

About two years ago, John Campbell, of the Superior Laundry in Cambridge, Mass. (right), initiated a new service. He undertook to launder a 20-pound bundle of family washing for $2. To make a profit he had to increase efficiency. The latest type of air-operated machines helped him to do this, and the so-called budget bundle proved highly successful. Within six months the laundry gained 400 new customers. News of the service spread rapidly among the trade, and more than 100 laundries in 50 cities now offer it to their customers. Above is shown a section of the Superior's shirt-finishing department where the number of presses increased from 7 to 41, all of them air operated. The presses bearing the numbers 53 and 56 have triple heads which iron the collar and both cuffs of a shirt in one operation. The presses at the right iron the fronts and backs. At the extreme right is a steam-heated sleeve form.



AIR SUPPLY

The increased use of compressed air in laundries has emphasized the importance of dependable compressors. Thanks to the reliability of modern machines, it is not necessary to install spare units. A few laundries in large centers of population require a compressor that delivers several hundred cubic feet of air per minute, but for the average plant a relatively small machine is ample. As air is ordinarily not used at pressures greater than 70 pounds, a single-stage compressor will usually meet the requirements. Motor-driven, air-cooled units are generally preferable because they are compact, easily installed, and need little attention. A compressor of this type that has proved popular and efficient for laundry service is shown in the accompanying illustrations. It is designated the Type 30, and is made by Ingersoll-Rand Company. It can be had in a large number of sizes, either single- or 2-stage. Above, in the right foreground is a 2-stage Type 30 operating presses at an exhibit of the American Laundry Machine Company at Cincinnati, Ohio. At the left are two single-stage units that supply air for a laundry at Fort Peck, Mont.

AIRWAY DRYER

In this machine garments are dried by an up-surge of heated air. Drying is 25 per cent faster than with the older equipment. This unit has solved one of the laundryman's most vexing problems, that of removing hair from barber towels. The 6-compartment dryer shown is made up of three 2-compartment units such as that in the insert.

for faster identification and virtually eliminating loss. Furthermore, skilled pen markers are not needed; the laundry is free from unsightly marks and pin holes; and the clips, unlike pins, can be run through the flatwork ironer. The substitution of the bulk method for the net system facilitates ironing; and a bright girl can learn to operate the Protecto in a few weeks.

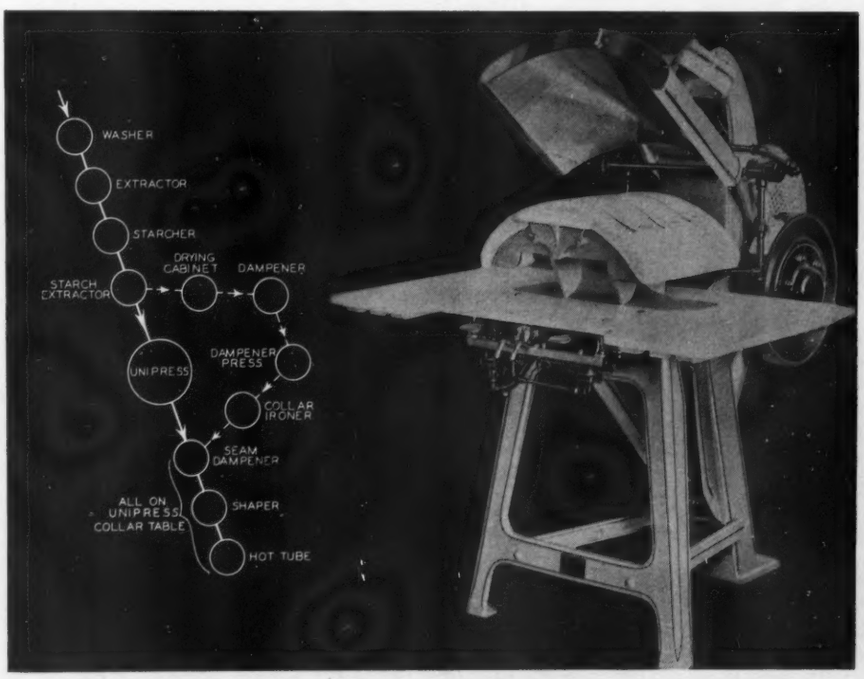
Several of the leading makes of cylinder or calender-type flatwork ironers now use compressed air instead of coil springs to control the pressure on padded ironing rolls. When ironing heavy pieces the pressure may be cut down, particularly in the case of wearing apparel to be flat-ironed in certain economy services. One make of chest-type flatwork ironer maintains a partial vacuum within the perforated padded roll, exhausting through the trunnion journal. Drying is thus speeded up considerably, because the big problem in ironing is to get rid of the moist vapor after it has been created.

One of the most timely changes that compressed air has effected in laundries is in connection with the ironing of starched collars, for which purpose there has been designed what is known as the Unipress. Today many laundries find themselves with a collar department far too big—too much machinery investment, too much floor space—for the few starched collars that must be handled. The Unipress, owing to the extraordinary pressure it develops through its unique double-flywheel inertia, irons three collars at one time without previous drying, dampening, or mellowing; and there is no finicky cylinder ironer demanding continual adjustment. Several laundries that finish collars in this way have reported a reduction in floor space of 75 per cent and in labor of 50 per cent.

The introduction of a pneumatic handkerchief ironer by the Huebsch Manufacturing Company, Milwaukee, Wis., marks a signal victory for compressed air. Prior to its commercial application, a few months ago, a special air-powered machine was available for every job of ironing excepting that of handkerchiefs. The Huebsch machine makes it possible for any ironing department to be 100 per cent air operated.

Incidentally, the rotary hydraulic bosom press, which was mentioned previously and which has been standard equipment in nearly every laundry in the country for the past twenty years, has finally bowed to compressed air. Certain changes, including the use of air in place of hydraulic power, have speeded up shirt ironing nearly 50 per cent. However, this type of ironer is generally found only in the larger plants.

In the shirt-finishing department of a modern laundry, one shirt a minute from a 4-girl crew is no exceptional performance. All ironing is done on pneumatic presses. Their frames are alike, but each has a buck that is shaped to fit the part of the shirt it is designed to iron. Radically different both in appearance and in operation is the Zarmo press recently announced by the American Laundry Machinery Company. Its frame is of structural steel instead of cast iron, and the ironing head, too, is no longer made of cast iron but of an aluminum alloy that has better heat-transfer properties.



LATEST COLLAR IRONER

The air-powered Unipress which has enabled a number of laundries to reduce by 75 per cent the floor space and by 50 per cent the labor formerly required for the ironing of starched collars. The diagram shows how this machine has reduced the number of operations on a collar from eleven to eight.

HANDKERCHIEF IRONER

Although it is flat, small, and of simple form, the handkerchief has, until recently, defied the efforts of laundry-machinery makers to develop an air-powered press to handle it. This Huebsch ironer utilizes the principle of the hydraulic shirt-bosom press save that it is operated by air with a simple diaphragm arrangement. While one damp handkerchief is being ironed, another is being placed in position on a square buck that is swung around for pressing. Such a machine does faster work than the conventional belt- or motor-driven ironer, and sells for less.

But Zarmo's most outstanding feature is the way in which the air is applied. The full force of a powerful cylinder is directed upward against the buck in a pinch-bar manner, and added pressure is exerted by piston follow-up. No pressure is lost through toggles or cams. Four compensating coil springs allow the buck to adjust itself to the varying thicknesses of the garments, or of padding, thus assuring uniform pressure against every square inch of surface. A second piston brings the ironing head down almost to the point of contact before the short pressure stroke is applied. Because the Zarmo irons quicker, has fewer parts, and uses less air, it is bound to be popular with laundry owners everywhere.

Another one of American Laundry Machinery Company's recent innovations is the Airway dryer for rough-dry garments and Turkish towels. It has only two moving parts: no revolving cylinder like other drying tumblers. Garments are dried by an up-surge of heated air—they actually float on air—from a Sirocco blower that is multi-V-belted to a 5-hp. motor. The Airway is made in units of two compartments, each of which may be operated independently. This is of great advantage, because it permits continuous operation—something that is out of the question with ordinary multi-pocket cylinder-type dryers which must be stopped to load or to unload a single pocket. The absence of a revolving cylinder makes it possible to add units and to connect them to a common vent. This, as may be appreciated, is of great importance to a growing laundry. Drying is done 25 per cent faster than in the past, largely because of a new method of recirculating warm air; and in the Airway's powerful blast (4,000 cfm.) suppliers of barber towels have at last discovered a means of removing hair from towels before ironing them—which was one of the most vexing problems of the industry.

Probably half the laundries in the United States now have dry-cleaning departments. The fire hazard has been eliminated in those that have installed cleaning units using chlorinated solvents such as carbon tetrachloride. After the garments are dry cleaned they are inspected by an expert spotter, at whose right hand is usually a spray gun with a mist nozzle that he uses continually on all silk garments after spotting to prevent the formation of rings. Until of late years this was accomplished by the aid of a damp chamois skin or sponge—a laborious and none too satisfactory a process. Innumerable laundries have provided their hand ironers with individual air sprays for dampening. Aside from the fact that they are more sanitary, they dampen more uniformly, serve to give work of better quality, and facilitate production. Today, air-spray guns are employed in a dozen different ways by dry cleaners—for raising the nap on suede jackets, for tinting leather coats, in refinishing velvets and silk curtains, for applying permanent moth-proofing solutions, etc. In fact, the dry cleaner has become so dependent upon compressed air that, should his compressor stop, he would forget his ante-air days and stop work too.

Large cleaning plants—those running six or more presses—are finding it economical to install vacuum machines for exhausting steam vapor from garments while they are being pressed. While presses of this kind are equipped with a steam jet for inducing a vacuum that is satisfactory, manufacturers are urging the use of auxiliary vacuum machines to assist in production as well as to lower cost and to decrease the load on an ofttimes undersized boiler.

All laundry presses are built to operate at 100 pounds steam pressure and 70 pounds air pressure. Consequently, boiler pressure is held at about 110 pounds and air-receiver pressure at 75 to 80 pounds. Depending upon its size and type, a press will consume from 0.05 to 0.12 cubic foot of air per piston stroke. Three strokes or operations per minute is the average. Thus a compressor delivering 10 cfm. can serve 20 to 30 presses; but it is reasonable to suppose that a laundry with 20 presses has many other air-driven machines in both its laundry and dry-cleaning departments and will, therefore, need a compressor twice or three times that size.

So suddenly and completely has compressed air become an indispensable part of a laundry that relatively few owners realize its importance. The well-equipped plant is provided with a standby boiler even though a steam boiler gives reliable service, because tubes, gaskets, or fuel will sometimes fail unexpectedly—usually at peak load, which means a peak-business period. Besides, but few laundries dare operate without either an extra power generator or an emergency electrical connection with the local utility. Laundry must be delivered on schedule: there is no time allowance for breakdowns. Yet innumerable laundry owners, with 80 per cent of their ironing machines dependent upon compressed air, have not given a thought to a standby compressor, nor will they until a breakdown occurs, or, better yet, until some obliging salesman sells them a unit for this purpose.

The tendency of laundries in buying compressors has been to select one just large enough for their existing air requirements. Laundry-machinery people are trying to discourage this practice: they are recommending an installation that will permit a 50 per cent increase. They are doing this for two reasons: First, because the laundry industry can confidently expect a substantial increase in the volume of its business: and, second, because each year finds compressed air doing some new tasks around a laundry.

If compressed air continues at its present rate to help laundries step up production and thus to lower costs, it will be the greatest single factor in helping the industry to realize its slogan—"A Billion Dollar Business by 1940."

Gold Mining in the Philippines

Ralph Keeler

CONTRASTING BUILDINGS

Shown above is the home of the American engineering staff at the Gold River Mining Company. The retaining walls are necessary to prevent the heavy rains from washing away soil, buildings, and all. The basketball court in the foreground is much used by the miners when off shift. The collection of grass huts at the left is a native village at the Suyoc Consolidated Mine. From ten to fifteen persons live in one of these structures, which are preferred to the wood-and-galvanized-iron houses built for them by the company.

MINING has become one of the flourishing industries in the Philippine Islands. Gold mining is on an established, successful basis, chromium mines of importance are being developed, and there are ample indications that iron, manganese, copper, and perhaps other base metals exist in commercial quantities. The increase in the price of gold from $20.67 to $35 an ounce in 1934 stimulated the gold-mining industry, with the result that the 1935 production was the greatest the islands have ever seen. The total output for the year just closed is estimated at more than $15,000,000.

There are two main gold-producing districts: one around Baguio, in the mountain province, 135 miles north of Manila, where seven mines are in operation; and the other at Masbate, a small island lying 262 nautical miles southwest of Manila, where several small properties are being worked. A promising new area now being opened up is the Paracale-Mambulao field, in Camarines Norte, which is 150 miles southwest of Manila by air and at least twice as far by train and boat.

Gold has been obtained in various parts of the islands for hundreds of years. As far back as the sixteenth and seventeenth centuries the Spaniards attempted to work mines in several provinces, but their methods were primitive and wasteful and did not meet with success. Before the Spaniards arrived, gold was laboriously produced by the natives of the coastal regions and found its way into China through the medium of Chinese traders who visited the Philippines in their junks.

Mines that were not so far inland as to be out of reach were the favorite raiding grounds for hordes of Moro pirates attracted thither by the yellow metal. In the Benguet Mountains, however, the Igorots kept their gold to themselves. Comparatively inaccessible from the coast, the settlements could not be penetrated by Chinese and Moro marauders. For hundreds of years no outsiders of any race were permitted to visit the quartz mines around Baguio nor to prospect for gold in the streams. A fierce and brave people, the Igorots have always won deep respect from all who have come in contact with them; and they were able to keep secret the sources of their gold supply until the Spanish-American War when American prospectors came with the army.

Pieces of Chinese pottery antedating the Ming Dynasty, picked up near old workings in Aroroy, Masbate, have led to the belief that the Chinese were active in Philippine gold mining long before Spanish times; and from China it is learned that gold was exported to that country from Luzon as early as 300 A.D. It is further believed that Javanese miners worked in Mindanao as long ago as 1350, and evidence thereof exists in the form of a golden image, supposedly of Javanese origin, that was found in a tributary of the Agusan River in Mindanao. This image weighs 1,790 grams and is wrought of 21-carat gold.

History repeats itself, for the best gold fields of today are those that were worked in former times. The Spanish knew as far back as 1544 that there was gold in Mindanao, Masbate, and Paracale. In 1574 a Spanish writer expressed enthusiasm about the gold mines of Luzon—he probably had the Paracale area in mind. The ruins of an old fort close to Mambulao recall a romantic figure of tradition, Doña Panay.

OUR COVER PICTURE

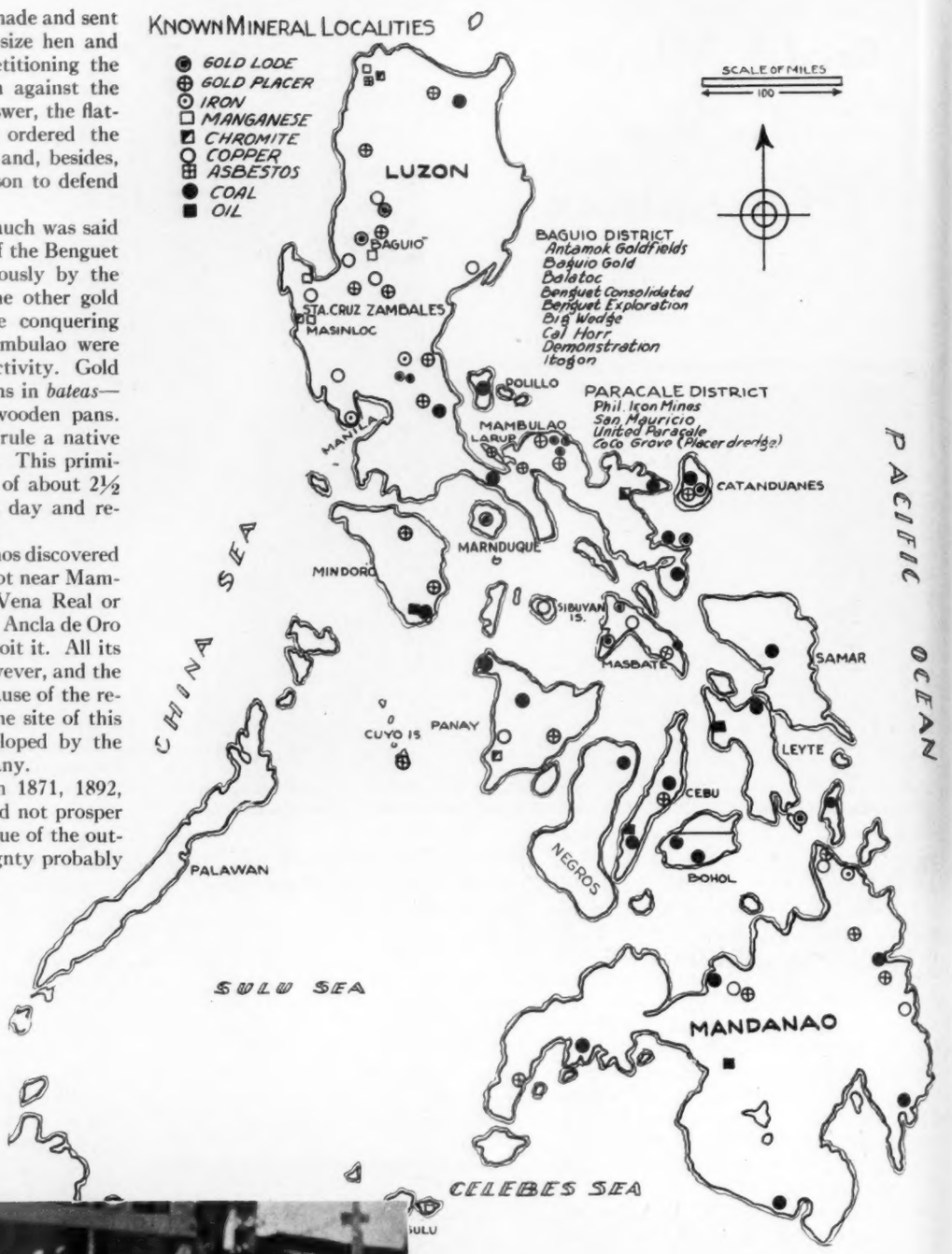
In 1903 Judge John W. Haussermann and associates formed the Benguet Consolidated Gold Mining Company and undertook to develop several properties. Through years of discouragement they persevered and won success. Today Judge Haussermann, president and general manager of the company, is called the "Gold King of the Philippines." He is shown in this picture standing on a hillside above the Benguet Consolidated Mine looking over the results of many years of work. Benguet camp is near Baguio. The mill is in the foreground. The groups of small houses are the native *barrios* or villages.

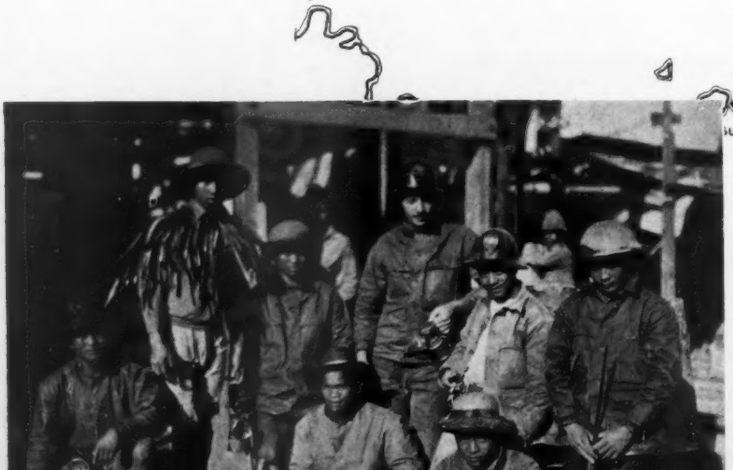
Of her it is told that she had made and sent to the Queen of Spain a life-size hen and chicks of solid gold when petitioning the Spanish crown for protection against the raids of Moro pirates. In answer, the flattered monarch immediately ordered the construction of a strong fort and, besides, commissioned a sizable garrison to defend it.

More than 300 years ago much was said about the rich gold deposits of the Benguet hills that were guarded zealously by the savages. But long before the other gold districts were known to the conquering Spaniards, Paracale and Mambulao were the scenes of much mining activity. Gold was washed out of the streams in *bateas*—wide, shallow, cone-shaped wooden pans. In the last years of Spanish rule a native dipper dredge came into use. This primitive machine had a capacity of about 2½ to 4 cubic yards of gravel a day and remained in service until 1908.

In 1626 Don Diego de Espinos discovered a vein of ore on Mount Calacot near Mambulao. This was called the Vena Real or Vena Grande, and in 1848 the Ancla de Oro Company was formed to exploit it. All its efforts proved unavailing, however, and the property was abandoned because of the refractory ore encountered. The site of this venture is today being developed by the San Mauricio Mining Company.

Companies were formed in 1871, 1892, and 1894, but gold mining did not prosper much, if at all. The total value of the output before American sovereignty probably





PHILIPPINE MINERAL RESOURCES

The principal mineral areas, developed and undeveloped, are charted above. Gold mining is flourishing, chromite is receiving great attention, and progress is being made towards the exploitation of other products of the earth.

COMING OFF SHIFT

An American shift boss and his crew of Igorot miners photographed as they came off duty at the shaft of the Gold River Mining Company in the Baguio district. Note the variety of costumes and the hand saws which the men use in their timbering work.

PLANNING THE DAY'S WORK

A morning conference at the Benguet Consolidated Mine. Reed Miller, mine superintendent (seated, hatless, at the head of the table), discusses with his American shift bosses what is to be done. Meanwhile, native *capatazes* or bosses stand and await their orders. Benguet Consolidated is the second largest gold producer in the Philippines.

did not exceed $50,000 a year, most of it coming from the Paracale-Mambulao district. Back in 1609 a writer made the statement that the Philippines produced $200,000 worth of gold annually—a figure that, at best, must have been a guess. William Ashburner, a noted American engineer who examined the Surigao properties in 1883, reported to his principals that about $20,000 in gold was mined yearly in that region, and he did not advise them to invest.

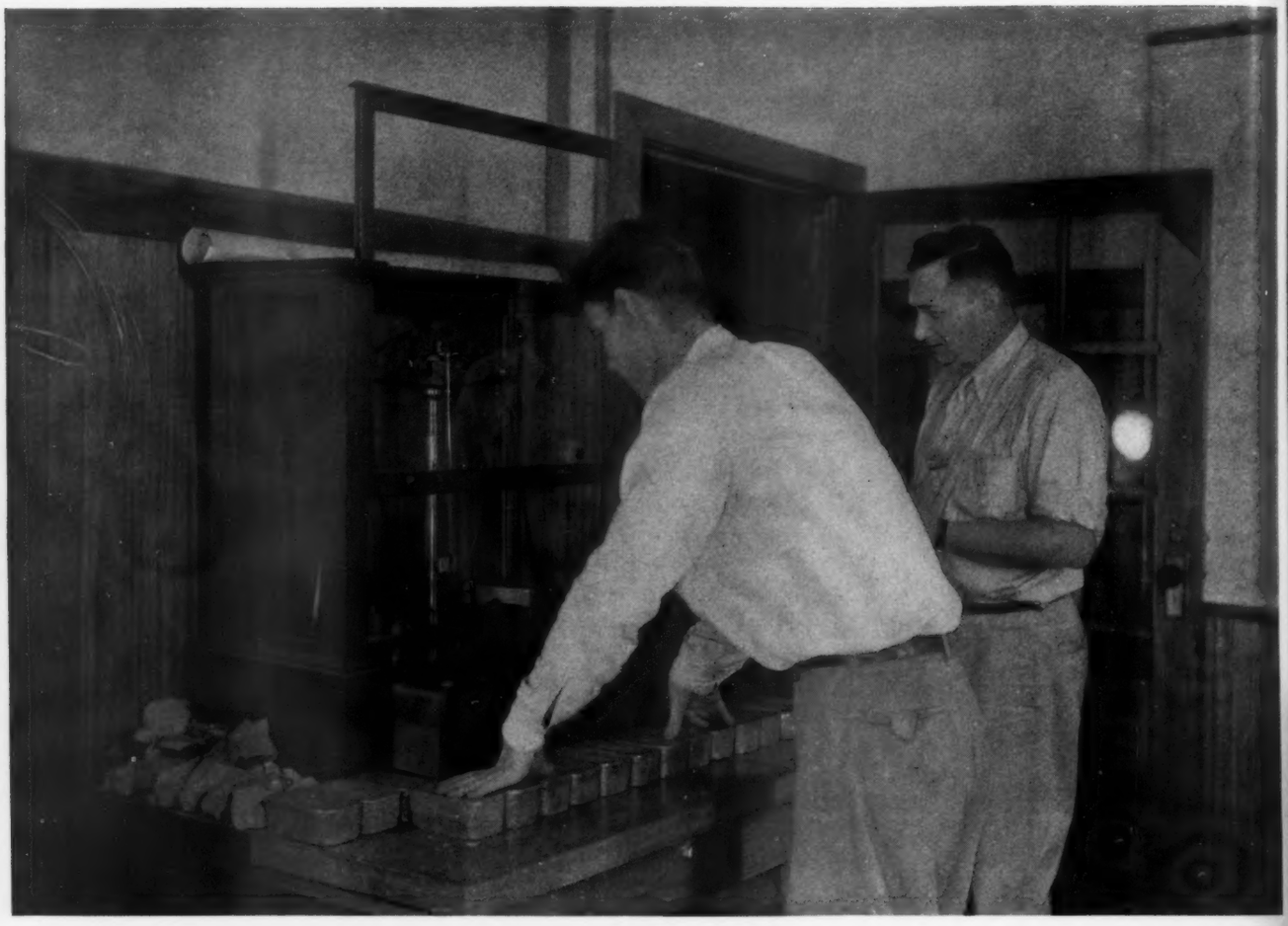
As previously mentioned, the revival of gold mining dates from the arrival of the American army, and particularly from the time that cyanidation superseded stamp mills and became the accepted method of treating the ore. Tales of riches to be found for the searching in the Benguet hills proved an irresistible lure to many of the soldiers who, at the conclusion of hostilities, chose to stay and to seek their fortunes. Among them were men with mining experience, men who feared nothing, and who were willing to brave the wrath of the Igorots or of anyone else where gold was at stake.

Their efforts soon showed results. The first activity was near Baguio, where a 3-stamp mill for treating gold and silver ores was erected in 1903. In 1907 there were three small stamp mills in operation in Benguet and two in Masbate. They were designed for the amalgamation process; but it was evident before long that more drastic measures were necessary. Cyanidation was introduced a few years later, and has been in use ever since. From 1908 to 1911 mining was carried on profitably near Baguio by the Benguet Consolidated Mining Company. Then a violent typhoon (the word Baguio means typhoon) completely destroyed its cyanide plant. The mill was rebuilt in 1914 and resumed operation within a year. Since then the company's success has been outstanding. It has acquired many other properties and is the largest gold producer on the islands.

The Masbate district was first developed while the American army was stationed at Aroroy. Several dredges were installed, and one stamp mill was set up. None of these ran for long; and the first steady production was in 1911 when the Colorado mill was finished. In 1913 two other mills were provided, and during 1912 and 1913 this area enjoyed the greatest prosperity that it had ever known and that has been surpassed only within recent years.

Dredging was the main operation in the Paracale-Mambulao field for a long time. Modern dredges of American, Australian, and New Zealand design were constructed; but they were gradually dismantled after a fairly productive period. In 1915, when the district was at its height, nine dredges were at work. Lode mining was attempted; but the stamp mills used did not handle the refractory ore economically. Activities in Mindanao and in a few other scattered areas did not yield much gold in the early days, but many of them are now being developed systematically.

Of the nine producing gold mines in the Baguio field and in nearby northern Luzon, three have been paying dividends for several years and two of them have latterly shown profits. By the end of May, 1930, there were but three producers around Baguio: Benguet Consolidated, Balatoc, and Itogon. Benguet was milling 300 tons a day, Balatoc 150 tons, and Itogon 60 tons. In the five years that have elapsed, Benguet has increased its capacity to 800 tons daily, Balatoc to 1,200 tons, and Itogon to 310 tons. To the successes achieved by these three mines is due most of the



CHECKING THE RESULTS

These seventeen bricks of pure gold were extracted from several thousand tons of ore at the Benguet Consolidated Mine and represent a part of the month's production. General Superintendent Dan W. Butner (right) is engaged in the pleasant but serious task of recording the weight of each brick. This mine maintains an integrated plant.

progress in that district and elsewhere on the islands.

Benguet Consolidated is the oldest and, at present, the second largest gold mine in the Philippines. The company was formed in 1903 through the efforts of Judge John W. Haussermann and his associates. Through many long years of discouragement, Haussermann persisted in his faith in the property; and the splendid results obtained are attributable to his hard work and determination. He is now the president and general manager of the company, and is justly termed the "Gold King of the Philippines." Benguet started paying dividends in 1915, and since that time its stockholders have received more than $13,000,000.

Balatoc is the largest plant on the island and also the biggest producer. In 1927, Benguet Consolidated acquired a 60 per cent interest in the company. Dividends have been paid since then; and the ore reserves indicate that it has a long and highly productive life ahead of it. Its 1934 output was worth $4,250,000, and at the present rate it will yield close to $6,000,000 in 1935.

Itogon is one of the islands' most efficient plants, treating a comparatively low-grade ore at a profit. The company, organized in 1924, declared its first dividend in 1932.

Baguio Gold is one of the best of the smaller operations, and has made steady progress since it was formed in 1930. Its mill capacity of 150 tons was increased to 200 tons during April and May, with a proportionate increase in output.

Antamok Goldfields is the newest company to pay dividends. The work of development was started in 1932, production began in July of 1933, and the monthly yield has been growing steadily. The company has a contract with the adjoining Gold Creek property, and commenced milling ore there in April, 1935.

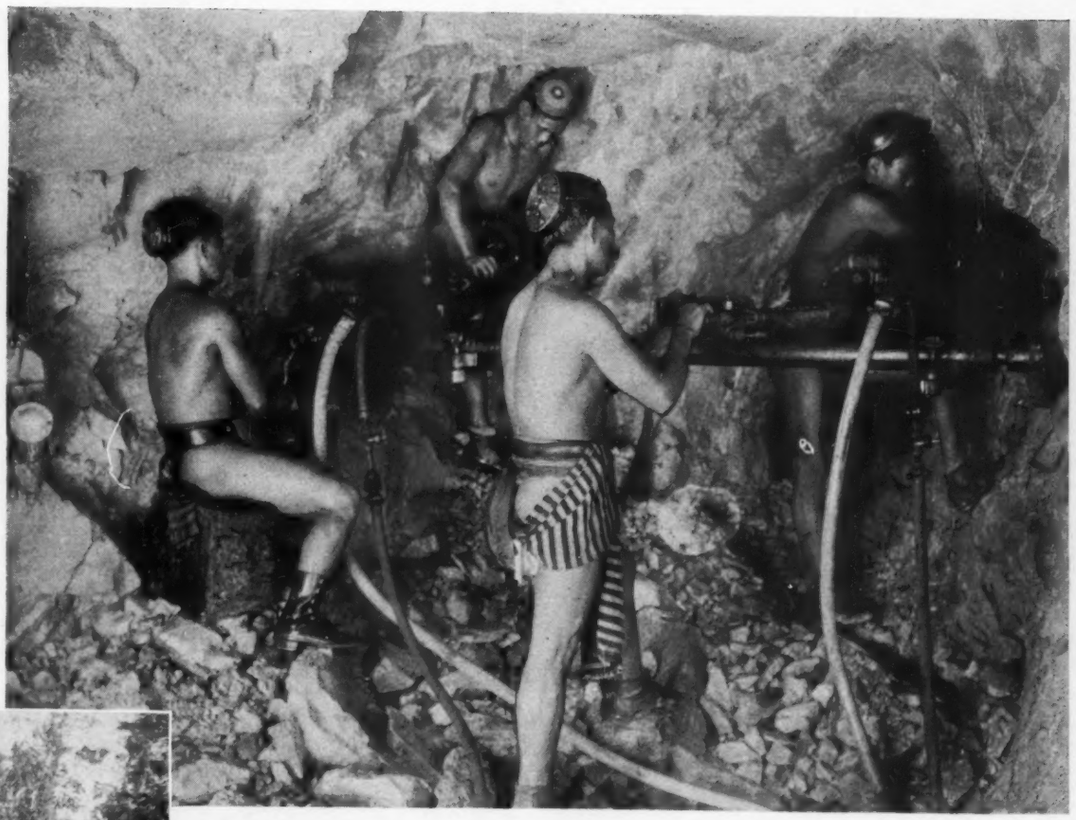
Ipo Gold is outside of Manila and a short distance to the north in the Province of Bulacan. It is being operated by Benguet Consolidated on a profit-sharing basis. Although mining was not begun until 1934, production has been declining recently, and it has been announced that the ore reserves are nearing depletion. Extensive exploratory work is going on, however, with the object of adding to the ore already blocked out.

Benguet Exploration is the only leaching plant in the Baguio district, all the others being designed for cyanidation, flotation, or a combination of both. The output of the 100-ton plant, which was started in September of 1933, has been increasing steadily, and present underground development indicates an ore body that may warrant a cyanidation plant.

Some 60 miles north of Baguio is located Suyoc Consolidated, which is operated by Marsman & Company. Its mill, which was put in service late in 1934, is a combination cyanidation-flotation plant with a capacity of 120 tons a day. The presence of nearly 1 per cent of copper in the ore has presented treatment difficulties, but these have been overcome. Concentrates and bullion are shipped to a California smelter for refining.

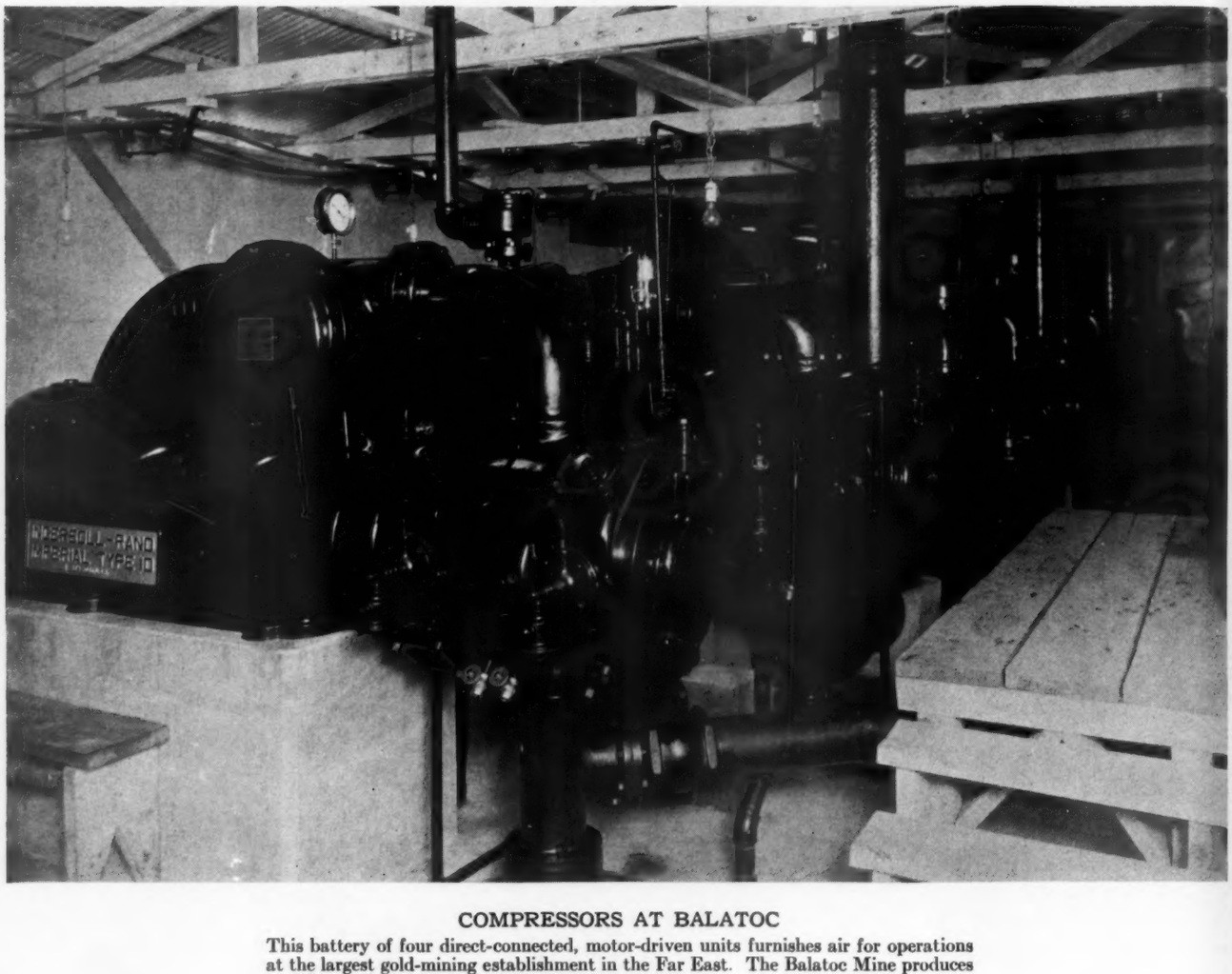
Demonstration is the newest mine in the Baguio district, and its record during the first four months of operation promises well for the future. This property was reopened in 1933 after fifteen years of inactivity. Production was begun in December, and has grown steadily since. The mill has a capacity of more than 160 tons a day, and plans to enlarge it are underway.

Baguio, for many years past a health resort and the summer capital of the archipelago since 1903, has grown to be a pros-



AT WORK AND AT PLAY

he top of the page Igorot miners from the mountain province of Baguio are shown Ingersoll-Rand drifter drills in the Balatoc Mine. The scanty costumes, includ- the little caps, are the usual apparel in wet and hot parts of the mines, although rican clothes have been adopted to some extent elsewhere. A bit of fun is pictured e right, where two adversaries in a pole-riding contest at Itogon attempt to un- each other with lusty swings of stuffed bags while the crowd gleefully watches. days are festive occasions at the mining camps. Games of various kinds, plenty od, and a dance normally contribute to the merry-making. The center view de- a Negrito miner of the Paracale district stalking a wild pig in the jungle with a and arrow on his day off.



COMPRESSORS AT BALATOC

This battery of four direct-connected, motor-driven units furnishes air for operations at the largest gold-mining establishment in the Far East. The Balatoc Mine produces and mills 1,200 tons of ore a day.

perous city of more than 10,000 inhabitants. Beautifully laid out, it is at once the most popular resort city in the Philippines and the wealthiest for its size. The mining companies in the district transact much of their business there, and the workers spend their money in its stores. Up-to-date hospitals and schools, well-paved streets, modern conveniences of all sorts, combined with mountain scenery and a delightful climate, make Baguio a truly remarkable mining center—one whose equal it would be hard to find anywhere.

And now we come to the Masbate field where Panique Mines is the largest producer. Its mill capacity of 300 tons a day has been increased recently to 500 tons. I.X.L., also on the Island of Masbate, has a steady output, while the Tinago and the Luya mining companies operate on a smaller scale.

The scene of the most intensive development today is the Paracale-Mambulao field. Once the richest producer in the Philippines, this district is being revived rapidly, and another year will see it contributing a considerable amount to the gold exports of the islands. In the Suyoc field, and farther north in Bontoc, properties are continually being examined, and a few likely mines are undergoing development. In Mindanao, at the other end of the archipelago, placer and lode deposits are being explored by the Marsman group as well as by several smaller concerns.

The future of the Philippines' gold industry looks bright. The two leading mining companies—Benguet Consolidated with its three producers, and Marsman & Company with its two—are expanding every month. Many less important ones, owning good properties but not financially able to develop and to prospect them properly, have made contracts with either Benguet or Marsman, to the best interests of all concerned.

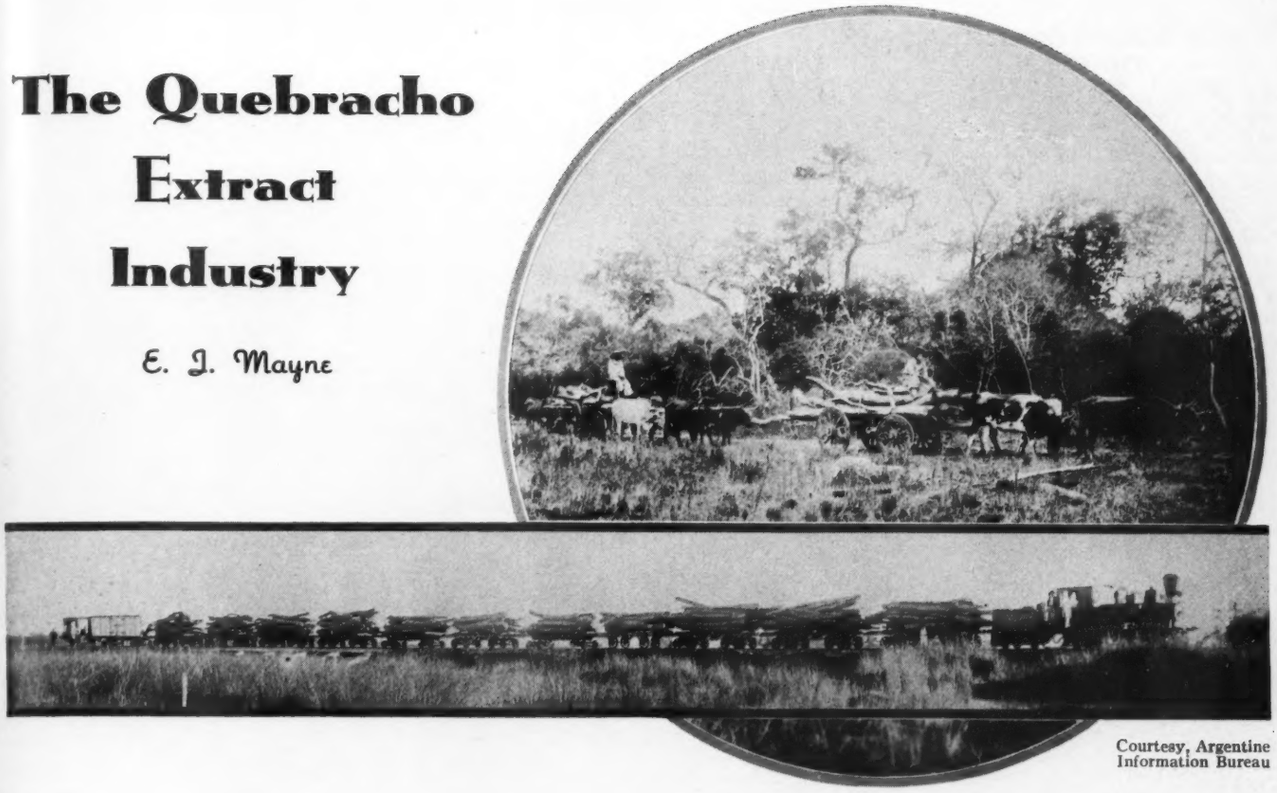
As is to be expected, the people of the Philippines are profiting tremendously by this growth in mining since 1930. Last year some 15,000 men were employed in the industry, with an estimated payroll of $3,500,000. Dependent upon that payroll were 70,000 men, women, and children. Living conditions for these laborers and their families have improved; they receive more money than ever before; and they have school and hospital facilities that were undreamed of in the past.

Gold mining is the most stable industry of the islands. Its influence extends to every nook and corner of the country. Stockholders, storekeepers, merchants—all share not only in the vast amount of money expended by the mines for supplies, equipment, payrolls, and in many other ways, but equally in the returns of those companies from the gold produced. It will be the backbone of the new republic. While attempts have been made to impose excessive taxes on the mines, it is not likely that the Filipinos will kill the goose that lays the golden egg.

While gold heads the list of the islands' mineral products, there is some activity in other branches of the industry. One iron mine, across the bay from Mambulao, is in operation and shipping 200,000 tons of high-grade hematite to Japan yearly. The chromite deposits of Zambales have been brought before the public eye recently. They are said to be the richest in the world, and are being opened up by the Benguet Consolidated Mining Company. Preparations for the production of the mineral are now underway; and Judge Haussermann visited the United States last year to arrange a market for it.

The Quebracho Extract Industry

E. J. Mayne



Courtesy, Argentine Information Bureau

HARVESTING THE LOGS

Extensive railroad systems have been built into the quebracho forests to facilitate timbering operations. Woodsmen, working in camps that sometimes number 500 persons, fell the trees and strip them of small branches, bark, and sapwood. The logs are then hauled by ox teams to the nearest rail line, whence they are dispatched to the extraction factories.

TANNIN, so called because of its power to tan raw hides—to convert them into leather, is derived from the bark and wood of certain trees. Tannin, or tannic acid, is a generic term that embraces a number of more or less similar compounds. In addition to being an aid to the leather manufacturer, which constitutes its chief application, it has many medicinal and other uses.

One of the principal sources of tannin is a species of quebracho tree that is indigenous to South America where it covers extensive areas. Quebracho means literally "break-ax"—the name being a tribute to the hardness of the wood of this tree. The fibrous tissues of the quebracho are so dense that the wood has a specific gravity of 1.2, making it an anomaly in the vegetable kingdom—wood that will not float in water. Like the oak, quebracho trees grow to a venerable age, and it is no uncommon sight to see specimens two centuries old being cut to pieces in a South American plant to recover their tannin-bearing extract.

Quebracho extract, in its commercial form, contains from 62 to 68 per cent tannin, which is a higher percentage than that in most other kindred substances. Vast quantities of it are used in the leather trade, the United States being the leading consumer. During the World War—when other tannin-bearing compounds, notably gambier, could not be regularly obtained—quebracho extract from South America made it possible for the allies to manufacture the large supplies of shoes and other leather goods that were required for military purposes. Its importance was at that time recorded by a writer in the *Leather World* of London in the following words:

"It may be emphatically stated without fear of contradiction that quebracho extract has been the backbone of the tanning industry during the period of the war. There is no tanning material which will tan through quicker or more evenly than quebracho, and for this reason it has been employed in the early stages of tanning in almost every tannery of the country. During the first year of the war it was hardly recognized how much reliance was placed on an ample supply of this material, for gambier was cheap and could be imported without difficulty, and there was a good supply of chestnut extract, as well as of home-made extract."

As the transport problem increased in difficulty, it became apparent that leather manufacturers had to depend upon quebracho extract, and to make sure that there would be no break in the supply, the British government interested itself in the industry that furnished it.

Curiously enough, the quebracho and the chestnut, the trees that contribute the two principal vegetable tanning extracts of commerce, have many things in common in the matter of occurrence. Both grow in the Western Hemisphere and in the same latitude, although one is found north of the equator and the other south of it. They are also alike as to the width of their growing belts, as to distribution in the areas in which they grow, and as to distance of the forested regions from the coast.

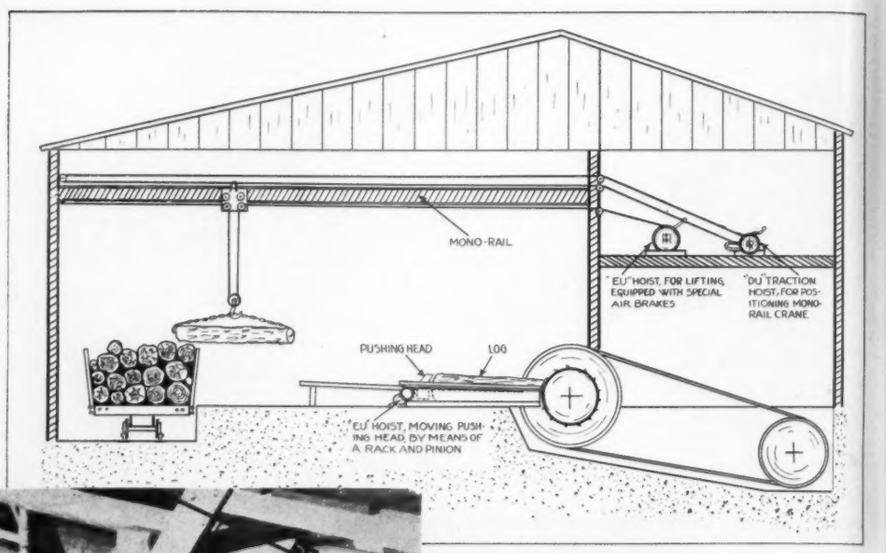
That quebracho wood was a source of tanning extract was discovered, so the story goes, about 1872 by a German tanner, in Buenos Aires, who observed that the water near a certain sawmill where quebracho railroad ties were being cut was very red and had characteristic tannin properties. He experimented with it in his tannery, and became the first quebracho tanner. Between 1875 and 1890 quebracho was used in Europe for tanning purposes, principally by "dusting" the hides with the ground wood. It was not until after 1890 that the extract from the wood became popular in Europe.

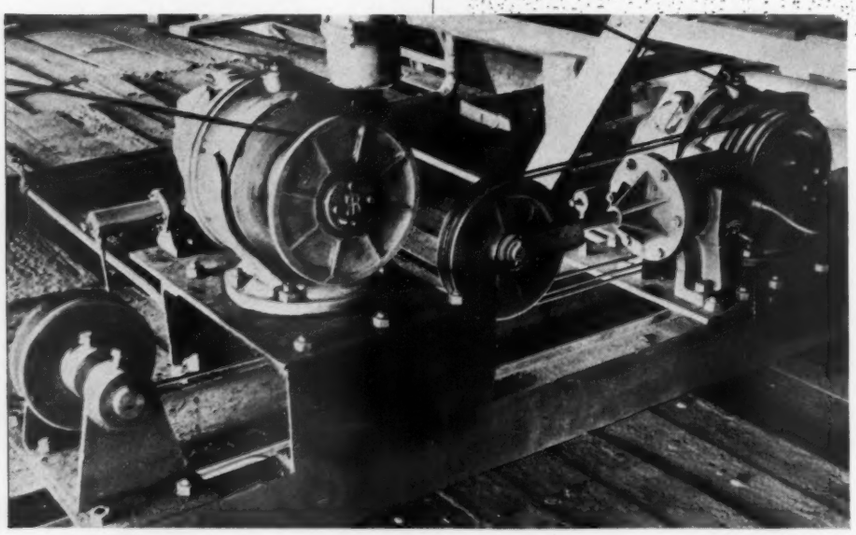
There are three varieties of quebracho trees: *quebracho colorado*, or red quebracho; *quebracho blanco*, or white quebracho; and *quebracho macho*, or male or strong quebracho. The red quebracho is the most abundant and also the most important source of tannin and of timber. The white quebracho is of value only for timber, as it contains no red wood from which the quebracho extract is obtained.

The red quebracho is found in a belt lying between latitudes 20° south and 31° south and extending north and south for a distance of some 750 miles. This zone starts approximately at the northern limit

HOW AIR HOISTS HANDLE THE LOGS

Material savings and numerous advantages have been effected as a result of the substitution of three air hoists for the manual methods previously employed at each chipping machine. As the diagram shows, two of the hoists manipulate the tackle by which logs are unloaded from a car and deposited on the carriage of the chipping machine. The third hoist furnishes the power for feeding logs to the chipping knives. An installation of the two hoists first mentioned is shown below. The left-hand unit raises and lowers the logs and is fitted with a special air brake designed to hold the load in suspension. The right-hand hoist controls the traction.





of Paraguay and reaches southward to a point about one-third down in the Province of Santa Fe in Argentina. Its eastern boundary is defined by the Parana and Paraguay rivers, from which streams it runs from 25 to 200 miles westward. The growth is not continuous: the trees stand in large groups which are sometimes elongated and irregular in form and which are separated by stretches of grass-covered or swampy land. Although there are some quebrachos in Paraguay, by far the greater quantity is in Argentina. In the latter country the trees are principally located in the Province of Chaco and in the northern part of Santa Fe, with lesser stands in Santiago del Estero and Formosa provinces.

Originally, the trees were found in Santa Fe throughout an area of 20,000 square miles. In 1924, when an investigator from the United States conducted a survey of quebracho resources in that region, it was estimated that there were at one time in this province some 37,800,000 metric tons of the trees. For 100 years the forests had been cut over for purposes other than obtaining tannin, and for 25 additional years for wood for the manufacture of the extract. These activities had reduced the stands so that by 1924 but 22,800,000 metric tons remained. The Chaco quebracho reserves, which spread over an area of 24,000 square miles, were then estimated to be 37,500,000 metric tons. However, the timber was not equal to that in Santa Fe, nor did it have the same high tannin content. Reserves in the Province of Formosa were placed at 9,000,000 metric tons; those in Santiago del Estero Province at 2,000,000; and those in Paraguay at 3,500,000 tons, making a total quebracho supply of 74,800,000 metric tons. Figures concerning the present reserves are not available; but as cutting has continued since 1924, they are bound to be somewhat less than those just cited.

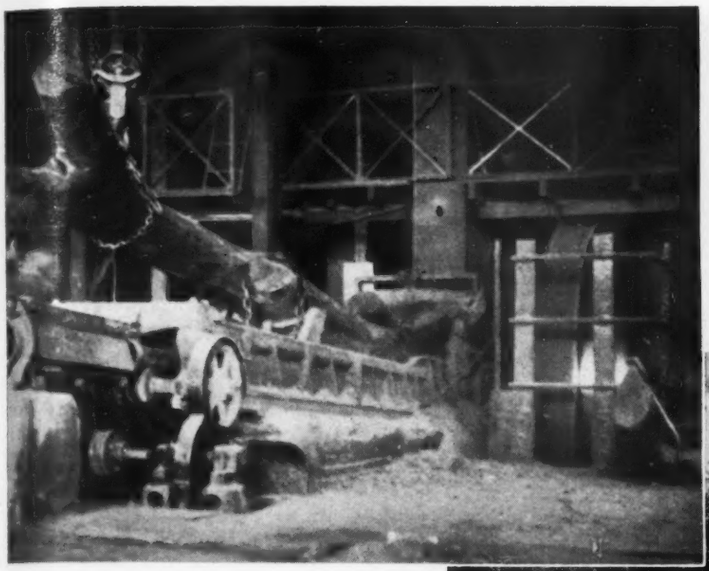
Wood from the quebracho tree is hard, water-resisting, of pleasing mahogany color, and takes a good polish. It has been utilized extensively in Argentina as a finishing material for the interiors of dining and sleeping cars. In its rough state the timber is much used in its native land for fence posts; sawed into lumber it serves for general building purposes; and it is also employed for making paving blocks. Red quebracho is considered to be as resistant to wear as any wood known. Ties and dock timbers that have been in service 40 years show no signs of weakness beyond surface weathering. Quebracho piling is said to withstand the teredo or shipworm, which is highly destructive to most wooden piling in tropical and subtropical waters.

The quebracho is distinctive in appearance and can be identified from a distance by the peculiar formation of its branches. The character of its bark also is such as to give it individuality. The trees do not grow close together, and while other varieties of trees are often found in the same grove, each quebracho stands out more or less by itself.

Climate and altitude affect the quality of the wood. The best trees are found towards the southern end of the belt, which is likewise true of the chestnut in this country. At the northern end, as many as 50 per cent of the trees may have heart rot, which is caused by moisture which is either absorbed from the ground or which filters through holes made by a huge borer. Decay is said never to occur from the outside. To make certain that a tree is sound before felling, the axman usually cuts a gash in the trunk.

In Paraguay all the quebracho land belongs to private interests: but in Argentina a large share of it is still owned by the government. It constitutes a valuable national resource. The general policy of the government has been to dispose of this timber land piecemeal through the medium of auction sales held from time to time—its value varying with the location, the density of the stands, and the quality of the trees. It may run as high as $100,000 per league (9.61 square miles).

The companies that prepare the extract generally own extensive areas of quebracho lands. In some cases they not only cut trees from their holdings but also buy them in the open market. The price paid is usually arrived at by bargaining. Purchases are made on a per-ton basis. Logging operations are normally carried on under contract, a stipulated amount being paid for delivering the logs alongside railroad tracks. The traditional method of opening



REDUCING A LOG TO CHIPS

At the left, a good-sized quebracho tree is being fed to the chipping knives. The log is pushed forward by a head actuated by a Size EU air hoist mounted underneath the carriage. The use of this simple equipment has made it possible to remove a miscellany of encumbering driving gear from the side of the chipper. The greatest advantage of the new arrangement is that it not only provides for automatic adjustment of the rate of feed but maintains the feed at the most effective rate. In the picture below, native woodsmen are cutting the bark and sapwood from a felled tree.

Courtesy, Argentine Information Bureau

up a new tract is to cut a series of parallel roads approximately one kilometer (0.62 mile) apart in the forested section. Cross roads are then constructed at intervals of one kilometer, thereby dividing the area into blocks.

The red quebracho has a heart of red wood, a surrounding layer of white sapwood, and an outer covering of bark. In a young tree the amount of heartwood is small, as compared with the thickness of the sapwood. As growth continues, the red core becomes larger and the white wood makes up a proportionately smaller part of the cross section. As the heartwood is the source of the tannin, trees are not desirable for treatment until they have attained an age of from 40 to 60 years. Accordingly, only the larger trees are ordinarily cut for this purpose. After felling, the axman strips off the limbs and bark and the 1- to 3-inch layer of sapwood, leaving only the clear, tannin-bearing red wood. It is stated that a workman can fell and clean about fifteen tons of logs a month.

After this preparatory work on the ground, the logs are measured, their weight computed, and they are then hauled to the railroad. The customary conveyance is a wagon drawn by two teams of oxen. These animals have been found to be superior to horses or mules for the purpose. They graze without cost to the owners, and when their period of usefulness has passed, they are fattened and slaughtered to provide meat for the camp. The extract companies have built many hundreds of miles of narrow-gauge railroad into the quebracho regions to transport the logs to their plants, and it is seldom necessary to make a wagon haul exceeding 10 miles.

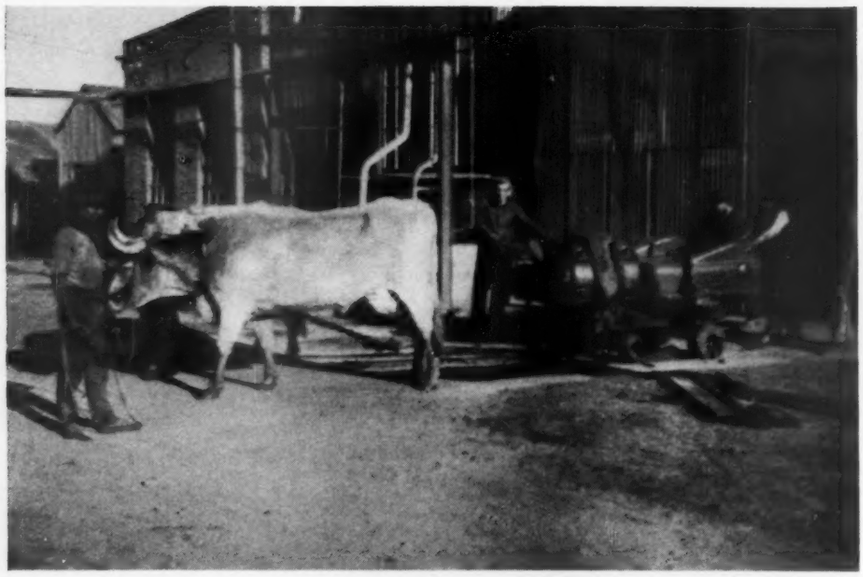
Contractors ordinarily recruit their own labor and furnish their own equipment. Their business requires considerable capital. There are usually as many as 500 workmen in a logging camp, and as their families generally go with them, the total population is often as much as 3,000. It takes something like $200,000 to outfit such an expedition. Excessive drought or excessive moisture stops the work in the field. The quebracho country experiences little precipitation; but it is periodically overflown by its rivers which are brought to flood stage by heavy rainfall farther north.

Among the leading producers of quebracho extract is the Forestal Company. This concern operates four finely equipped plants in Santa Fe Province, and is also interested in several other factories. It owns about 1,000 kilometers (620 miles) of railroad, together with the needful rolling stock and locomotives, for bringing in the logs.

The process of extraction as practiced there is, briefly, as follows: The logs are cut into small chips, which are elevated and fed through hoppers into a large vertical copper diffuser or cooking vessel. Hot water, which is pumped in at the top, circulates through the chips and withdraws the tannin. The liquor, which contains from 10 to 12 per cent of extractives, flows through a metering device and then to storage tanks. The spent chips are meanwhile conveyed from the diffusers to the boiler house, where they are utilized for fuel.

The weak extract is next concentrated in multiple-effect evaporators. It is impossible to obtain more than 50 per cent solids, however, as the liquor thickens so much that it will not boil. In order to remove more of the water content, the extract is transferred to single-effect evaporating pans which are equipped with mechanical stirring devices. The resulting liquor is very viscous. It is run out of the pans into bags having a capacity of 50 kilograms (110 pounds). The product cools and hardens rapidly, and within 24 hours it is ready to be stored or shipped.

It can be readily appreciated that the handling of the heavy logs during the first stages of the process is somewhat of a problem. These operations have recently been much facilitated by the use of air hoists—an improvement that has reduced costs materially and bettered general conditions. It is the practice to store great quantities of the logs at the factory so as to insure against plant interruption in case the flow of raw material from the forests should stop by reason of bad weather or other causes. Logs from these stock



MOVING IN A COMPRESSOR

The frame of a 100-hp., Type XRB-2 compressor, typifying mechanical efficiency, is being drawn to the engine room of the La Gallareta plant of the Forestal Company by a team of oxen, traditional beasts of burden of South America.

piles or from the field are conveyed to the chippers by railroad cars. Formerly they were lifted from the cars by manually operated chain blocks, which required the services of two men. After being raised, the logs were run along a monorail and lowered on to the carriage of the chipping machine. An accompanying diagram shows how this work is now done by the aid of two Ingersoll-Rand air-driven hoists. One operates the tackle for lifting the logs from the car and for lowering them into position on the carriage: the other moves the load along the monorail by means of cables.

The traction hoist is fitted with an ingenious cable-tightening device consisting of an air cylinder and a grooved pulley. Both hoists have been made reversible by providing each with two opposing air cylinders the pistons of which are connected by a rod having a toothed rack that engages the hoist's rotating reversing gear.

Another hoist installation is doing very effective work in feeding the logs to the chipping mechanism. A chipper is composed essentially of a cast-iron trough in which the logs are placed, of a head that pushes the logs, and of a rotating drum fitted with toothed knives which reduce the logs to chips. Previously the head was moved by friction drive, consisting of worms and worm wheels and of belts and pulleys. This was a very cumbersome arrangement, and was expensive to operate. Obviously, the speed of the head, to be effective, should vary with the diameter of the log and the number of logs chipped. If the maximum output of the chipper is to be maintained without overloading, then a thick log must be fed more slowly than a thin one.

In an effort to improve upon the method, Sr. J. Petersen, factory engineer for the Forestal Company at its Villa Ana plant, which is said to be the largest of its kind in the world, began experimenting with an Ingersoll-Rand air-driven hoist as a means of actuating the head. This work was done under the supervision of Sr. Fernando Fontana, technical adviser to the company. All gears and other paraphernalia were removed from one of the six chipping machines installed there. In their place was mounted a simple mechanism consisting of a Size DU hoist connected by a flexible coupling to a single-gear reduction which engaged the pinion of the rack that set the head in motion. Tests proved this arrangement to be far superior to the old one. When put to practical use, but one change was made, and that was to substitute a more powerful hoist—a Size EU—for the one originally tried. Each chipper was thus provided with three hoists, which were operated from a remote-control station by the man in charge of that chipper.

The capacity of the chipping machines has been measurably increased by reason of the adaptability of the motor in this type of hoist. The valuable feature of the air motor is that its speed—and, in this case, that of the head—automatically accommodates itself to service requirements, and thus meets the need of each log fed to the chipper. Small-diameter logs are speeded up to a point at which the machine can maintain full capacity, while heavier logs are no longer fed so fast as to choke the chipper and to damage the knives.

Following the success of the trial runs, five of the chipping machines at the Villa Ana factory were provided with three hoists each, and steps were also taken to equip those at the company's La Gallareta and Tartagal plants in the same way. As a result of their installation, the Villa Ana factory has been able to reduce the number of chippers in regular service. In place of six machines—five in operation and one in reserve—the normal requirements can now be filled by three machines, one of which serves as a standby. The cost of chipping logs and the expense of repairing the chippers have been reduced by about one half. These savings will be sufficient to pay for the new equipment in a short time.

Compressed air for the hoists at the Villa Ana plant is supplied by an Ingersoll-Rand 100-hp., Type XRB-2 compressor which is belt driven from a line shaft running beneath the engine-room floor. A 100-hp. compressor has been purchased for each of the two other factories. Their full capacity will not be needed for the operation of the hoists, and the surplus will be used for the pumping of water by air-lift. In addition to the local industry, some quebracho logs are exported to extraction plants in other parts of the world. One of the latter is located in the United States at Wilmington, Del.

ON AN INSPECTION TRIP

Sr. Fernando Fontana, technical adviser to the Forestal Company, uses an airplane to visit the scattered factories under his supervision. He is shown in the center, in company with his pilot and his mechanic.

HE MADE DESERTS BLOOM

THE death, late in January, of Dr. Elwood Mead, Commissioner of the U. S. Bureau of Reclamation, deprived the nation of one of its most capable and most helpful public servants. Thousands of persons have reason to give thanks that Doctor Mead lived. Vast expanses of land in the West that were arid wastes when he went to Washington are now dotted with productive farms. He changed the landscape from brown to green; the flora from sagebrush to grain, alfalfa, and orchards; the fauna from coyotes to dairy herds and sheep.

Doctor Mead was one of those rare individuals whose value, integrity, and high purpose are so apparent as to render them immune to the effects of changing political tides. From the time of his appointment by President Coolidge, in 1924, he served under three presidents and two political parties. His deep understanding of his duties, and his sincere, businesslike administration of reclamation affairs made his position secure from partisan interference.

He was not a superman, and he had no magical touch. The story of his success ran true to the old pattern. He became an expert in reclamation because he spent a lifetime studying it. It was both his work and his hobby. He never tired of his job. He knew the topography and the people of the West with equal intimacy. He considered water their most valuable resource, and he pointed the way to its beneficial use. When the State of Wyoming was formed, nearly 50 years ago, he formulated its irrigation laws. They departed from established principles and were based on state ownership and stewardship of all water, surface and underground. The justice of this was soon recognized. Before long Doctor Mead was acclaimed an authority on matters pertaining to irrigation.

Doctor Mead kept a finger on all phases of the work of his department. Despite increasing age and the handicap of the loss of an arm in an accident some 25 years ago, he walked, rode horseback, and flew in airplanes over the areas where projects were underway. At 78 he had all the vigor of a man in his prime, and was active in the conduct of his office until the brief illness that preceded his death.

While many dams were built under his regime, the crowning achievement was, of course, the construction of Boulder Dam. Happily, Doctor Mead lived to see this great structure substantially completed.

NATURE'S TESTING LABORATORY

STERN tests have been imposed upon highways by the winter that is now drawing to a close. Jack Frost has proved to be a veritable Paul Bunyan, his innumerable fingers prying, gouging, buckling, and otherwise deforming pavements of various sorts. Only the best-built roads have escaped unhurt.

It will take a long time to appraise the damage. Every large city in the northern half of the country will be making repairs far into the summer. In Baltimore alone it was estimated late in February that it would cost $1,000,000 just to restore the street surfaces to their former smoothness. Some other communities will no doubt be confronted with equal or even larger bills. Nor will the cost of patching represent the true cost, for the effects of freezing will inevitably hasten the day when the pavements will have to be replaced.

The invasion of cold reached farther south than it usually does, and damage was very extensive in states that are normally out of range of all except an occasional light touch of frost. The North has learned to protect surfaces to prevent the entrance of water which may later freeze and expand, but such a precaution is ordinarily not necessary in Dixie.

South of the ice and snow belt, the storms took the form of heavy rains, and all but the hard-surfaced roads were rendered well-nigh impassable. Continual attention by maintenance crews was required to keep them open, particularly where trucking cut the soft surfaces into ruts and chuck holes.

Expensive though it will be, this demonstration by Nature will undoubtedly provide highway engineers with comprehensive data that will enable them to construct more durable roads and streets.

THE EFFECT OF MACHINERY

A CONVINCING presentation of the premise that machinery has created jobs instead of having removed them has been issued in pamphlet form by the Machinery and Allied Products Institute with headquarters in Chicago. Under ten headings it gives statistical data developed from a study of the relation between technology and unemployment.

It is pointed out that during the past 60 years—the period marked by the greatest advance in mechanization—population has increased 218 per cent while gainful employment has risen 291 per cent. Occupations that showed the greatest growth during the years from 1920 to 1930 absorbed three times as many persons as did those that declined most in the same interval. According to Federal figures, only 4 per cent of the 2,500,000 unemployed persons contacted in 1930 held machinery accountable for their loss of work.

Employment is at the highest level today in those industries that make the most use of machinery—outstanding examples being automobile and textile plants, paper factories, and printing establishments. Industries that have made the greatest technological advance are the greatest employers of labor, while those that lag in mechanization have jobs for fewer persons.

Only 40 per cent of our population normally desires work. This means that if machinery were not available there would actually be a labor shortage, as it would take 60 per cent of the people to provide the goods and the services demanded by the higher standard of living which has evolved since 1900.

Emptying Carboys with Compressed Air

THE handling of acids delivered in carboys, usually a ticklish business, has been made safe and easy by a simple device that has been designed and put on the market by the Lea Manufacturing Company.

It obviates the need of lifting and tipping the heavy containers preparatory to pouring, and thus prevents spilling the corrosive liquid and, possibly, injury to those transferring the acid and damage to property. By means of it, as the accompanying illustration shows, the contents can be drawn off in any desired quantity into a vessel without the man engaged in the work even coming in contact with the carboy.

The Lea Acid Ejector, as it is called, is a portable outfit that consists essentially of a little electrically driven air pump, of a carboy plug with an air inlet and a rubber seal, and of a U-shaped pipe connection made of suitable acid-resisting metal. The pump supplies sufficient air to force the fluid up and out of the container through the pipe, the air being introduced by means of a hose and nozzle that is held against the opening in the plug by the operator. Depending upon the level of the liquid, it takes from 10 to 30 seconds to build up sufficient pressure to cause the acid to flow. To check it, it is necessary only to relieve the pressure by withdrawing the air hose. The ejector can, of course, be used with any liquid delivered in carboys, but of the two models available one is designed for the handling of hydrochloric and sulphuric acids and the other for nitric acid.

Decorating Luxury Ships with Rare Stones

THE efforts of luxury-ship designers to outdo each other in the beauty and rarity of the appointments of their vessels is leading to the use of unusual and interesting materials for decorative purposes. A ship now being fitted out in Europe will be ornamented with onyx from North Africa, with marble from Malta, and with golden quartzite. The last-named was known in the days of the Pharaohs, for some of it was found in the tomb of King Tutankhamen. The onyx and the marble are being used for fireplaces, and the quartzite for paving the swimming pool.

Quartzite, it is recorded, was quarried by monks in the twelfth century. They had to chop and shape it as best they could, for they were unable to cut it. For hundreds of years thereafter the quarries remained untouched, and then, in the eighteenth century, Italian monks in the Alps began to employ the stone again, and examples of it can be seen in numerous Italian churches. After much experimenting, ways have been found to work quartzite, and it is now to be found in modern buildings.

Malta marble comes from the Isle of Gozo near Valetta, and is shipped from St. Paul's Bay where, tradition has it, the apostle after whom it was named preached from a small boat. Its first use in Europe was in the Jubilee House recently built for the late King George V of England.

Detectors Control Boiler-Plant Smoke

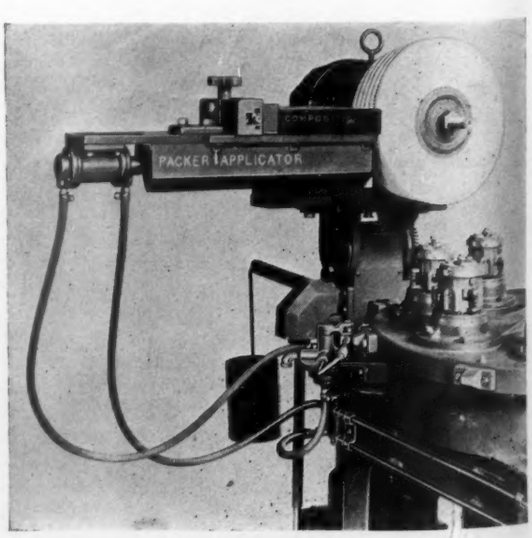
THE problem of smoke abatement is one of vital concern not only to industrial plants but also to the communities in which they are located. An interesting method of checking the nuisance is reported by the Lake Union plant of the Seattle Gas Company. Three of its nine boilers are oil fired, the remainder using solid fuel as well as tar. Each of these boilers, together with the stack, has been equipped with a detector that gives warning of smoke, thus making it possible to pick out and to attend to the offending boiler or boilers before a long column reaches the stack. All these units are suitably protected against heat.

The signaling device in the stack consists of a photoelectric cell and a light—a cloud of smoke rising between the two blanketing the light and causing the electric eye to operate the alarm relay. Obviously, the glass surfaces of the lamp and the "eye" must be kept clean if they are to function properly. To this end, both are kept free of soot and cinders by compressed air, which is directed against them by a small nozzle with which each is provided. By means of a microammeter, which is connected with the unit in the stack, a record is kept of the intensity as well as of the duration of the discharge. From the standpoint of boiler operation, the alarm system is said to be proving highly satisfactory, and has been instrumental in cutting down the average smoke-producing period from 7.5 minutes to 0.94 minute per hour.

Pneumatic Feed for Automatic Polishing Machines

BUFFING and polishing operations in connection with metal products have been put on an entirely mechanical basis by the Packer Machine Company through the introduction of its automatic applicator. This unit was designed especially for use with its own machines, but it can readily be mounted on others by means of a suitable bracket. As the name implies, the applicator feeds to the buffing and polishing wheel the composition that is required to give articles of various metals and kinds their finishing touches. The material employed is in cake form and is held in jaws that can be adjusted to accommodate cakes up to 11 inches long, 6 inches wide, and 1½ inches thick. All but a small portion of the compound is taken up by the wheel.

The applicator is operated with compressed air, which is delivered at a maximum pressure of 60 pounds. It is equipped with a reducing valve so as to control the pressure of the feed. The amount of the feed is also regulated to meet service requirements. As contrasted with hand-feeding, the machine not only applies the composition in just the right quantity but also the instant it is needed, thus producing work that is uniform in character at all times and doing it at a greater speed and less cost.



Industrial Notes

Germany has put a new line of synthetic plastics on the market under the trade name of Acronal. They are clear and colorless polymerized vinyl compounds that are claimed to be unaffected by low temperatures and petroleum products and to have an elasticity equal to that of hard rubber.

Stainless steel is being put to a very unusual use in Yorkshire, England, where a stretch of river bed is being covered in part with thin sheets of the metal in connection with the construction of a reservoir. The sheets rest on the concrete bottom of the channel, and are designed to prevent the latter from becoming choked with marine vegetation.

Artificial pumice is being made in Germany by a process in which obsidian, a volcanic glass, is preheated to a temperature of 1,652°F. and dropped down a shaft furnace against a rising draft of hot gases. This treatment causes it to swell into porous particles which are many times their original size and which are consolidated with lime or cement. The resulting material is used as an abrasive.

Colored limestone for interior decorative purposes may become popular and increase the demand for that building material if a recently developed process of impregnation proves to be successful. Fred Bluem and his son, of Bloomington, Ind., are the inventors of the process, by which they have been able so far to produce satisfactory effects with such colors as red, purple, lilac, brown, and green. The pigment penetrates the stone to a depth of from ¼ to ½ inch; and time is said to deepen rather than to fade the color.

A process by which ordinary steel can be made resistant to corrosion has been announced by Dr. H. K. Ihrig, chemical engineer of the Globe Steel Tubes Company, Milwaukee, Wis. According to Doctor Ihrig, the process is akin to case hardening, except that the steel is impregnated with silicon instead of carbon and is not given a surface coating. Specimens subjected to boiling in a nitric-acid bath showed no traces of corrosion even though the bath tank of galvanized iron had to be replaced in ten days. The process is known as Ihrigizing.

One of the newest additions to the motion-picture library maintained for public use by the U. S. Bureau of Mines is the film entitled *The Story of Nickel*, which portrays the mining of the ore, its crushing, pulverizing, electrolytic refining, and casting, as well as its application both in the home and in industry. This 2-reel film is available in either 16- or 35-mm. size, and may be borrowed without cost other than that of transportation by educational institutions, clubs, and kindred organizations. Application should be made to the Pittsburgh Experiment Station, U. S. Bureau of Mines, Pittsburgh, Pa.

A development in metal spray guns is announced by the Gillord Sales Corporation. The tool is permanently mounted or is freely suspended, depending upon the character of the work to be done. Its capacity varies with the melting point of the metal used, depositing, for example, from 12 to 15 pounds of alloy steel or from 25 to 35 pounds of copper per hour. One of its principal features is said to be a small chamber in the head of the gun where the metal is melted and where the latter is enveloped by an inert gas that protects it against oxidation up to the point of deposition.

One of the by-products in the manufacture of wood pulp for paper-making is sulphite liquor, which is now being extensively utilized by reason of its sugar content for the cultivation of baker's yeast. In this work of propagation are used large quantities of compressed air for the purpose of freeing the liquor of gases developed during fermentation and for protecting the yeast from the poisonous effects of the liquor. In one plant, 2,000 cfm. are required for each fermentation tank, which has a capacity of from 2,000 to 4,000 pounds of yeast. This plant is located near the seashore to assure a continuous supply of clean air; but, as an added precaution, the intake of each compressor has been provided with an air filter.

The U. S. Bureau of Mines has announced that it is making a study of the milling characteristics of typical ores representing various districts throughout the United States. That this investigation may be as complete as possible, it is offering the services of its ore-testing section free to anyone submitting samples that are acceptable. Such tests, however, are made with the understanding that the results obtained be kept strictly confidential until released for publication by the Bureau. Information offered to the Bureau in this connection must be sent to its director on Form 284, which may be obtained from C. W. Davis, Supervising Engineer, Ore-Testing Section, U. S. Bureau of Mines, College Park, Md.

The Eimco-Finlay Loader, in a new bulletin recently issued by The Eimco Corporation, Salt Lake City, Utah, is described as a "self-propelled, efficient, sturdily built shovel that reduces mining costs and increases drifting speed." Since this shovel—the product of a practical mining man—was introduced, it has found application both here and abroad in tunnels, mines, and other confined spaces below or above ground where mucking has to be done. Its structural features were given in detail in the February, 1933, issue of this MAGAZINE, and have remained much the same as they were at that time. Two sizes are now available. The Model Eleven is designed to operate wherever headroom is low and width limited. It can be furnished to run on track ranging in gauge from 18 to 30 inches and to load cars of any practical length and having a maximum height above the rails of 54 inches. It has an average loading capacity of from 30 to 50 cfm. The Model Twenty is built for work in larger drifts and tunnels, for tracks of from 24- to 42-inch gauge, and for mine cars of standard length and of a height not more than 66 inches above the rails. The latter has a rated average capacity of 50 to 80 cfm.

Work on the Thames Tunnel, England, between Dartford, Kent, and Purfleet, Essex, will be started this year, according to the British Ministry of Transport. The undertaking will be completed in about four years at an estimated cost of $15,000,000. In addition, there are to be constructed important arterial highways that will link the tunnel with existing traffic routes. The tunnel will probably be built at a depth of 40 feet below the river. The only point along the route where engineering difficulties are likely to be encountered is on the north side of the Thames, where special precautions will have to be taken because of the nature of the formation. There are other tunnel projects under consideration in England. One beneath the Humber, and a road tunnel under the Severn. The northeast coast is also planning to tunnel the Tyne.

Cast iron is recommended as a roofing material, and in proof of its enduring qualities is cited the fact that the great dome of the National Capitol in Washington, D. C., has a cast-iron roof that was laid in 1870 and has required no outlays for maintenance since then. Going still farther back for evidence, the cast-iron roofs of three structures forming a famous Chinese temple are said to be in excellent condition even though they are about 500 years old. And this brings us down to an announcement by the United States Pipe & Foundry Company, Burlington, N. J., to the effect that it is offering standardized cast-iron plates and caps for roofing industrial buildings. Each plate is a single casting, and is 3/16 inch thick, 24 inches wide, and 52 inches long, which is also the length of the semicylindrical cap. The latter fits over flanges, one on either side of each plate, that impart strength to the casting and prevent leakage at the joints. A number of such roofs have already been built. While not exactly new, it is said to be the first time that cast-iron roofing has been manufactured and sold on a commercial basis.

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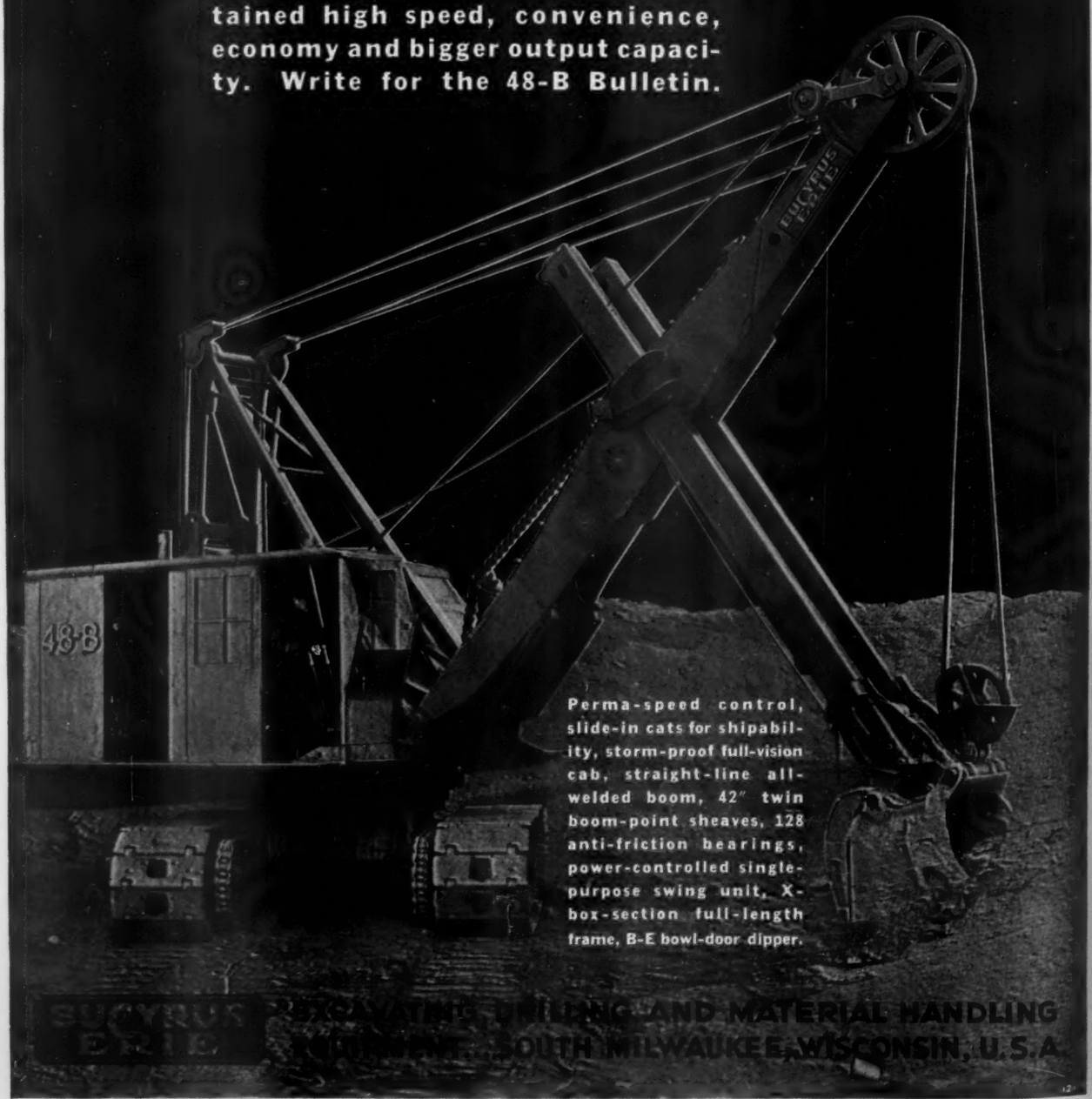

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